Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

84 M
no. 120

UNITED STATES DEPARTMENT OF AGRICULTURE
MISCELLANEOUS PUBLICATION No. 120

WASHINGTON, D. C. APRIL, 1932

A DIGEST OF THE LITERATURE OF DERRIS (DEGUELIA) SPECIES USED AS INSECTICIDES, 1747-1931

By

R. C. ROARK

Principal Chemist, Insecticide Division, Chemical and Technological
Research, Bureau of Chemistry and Soils

U. S.

For sale by the Superintendent of Documents, Washington, D. C. - - - - - Price 15 cents

UNITED STATES DEPARTMENT OF AGRICULTURE
MISCELLANEOUS PUBLICATION NO. 120

Washington, D. C. March, 1932

A DIGEST OF THE LITERATURE OF DERRIS (DEGUELIA) SPECIES USED AS INSECTICIDES, 1747–1931

By R. C. Roark, *Principal Chemist, Insecticide Division, Chemical and Technological Research, Bureau of Chemistry and Soils*

INTRODUCTION

Derris[1] is a genus of tropical plants comprising about 40 species. It is a member of the subtribe Lonchocarpinae of the tribe Dalbergieae, belonging to the family Fabaceae, which some botanists call Leguminosae or Papilionaceae. Derris is native practically throughout the Tropics, but it is far more abundant in the Old World than in the tropical Americas. Its members are mostly climbing shrubs, having trunks 3 or 4 feet in height and about 4 inches in diameter. From the trunks project numerous long branches, which climb over the neighboring vegetation, and the tips hang freely downward.

From *Derris elliptica*, *D. pinnata*, and *D. uliginosa* the natives of Borneo and the Malay Peninsula have obtained extracts used as ingredients of arrow poisons. The following species have been used to poison fish: *Benthamii*, *elliptica*, *forsteniana*, *guianensis*, *negrensis*, *philippinensis*, *pinnata*, *polyantha*, *scandens*, and *uliginosa*.

---

[1] The name *Derris* Lour., which has been used for this genus not only in practically all chemical literature but also in most botanical literature, is antedated by *Deguelia* Aubl. Under the American code of botanical nomenclature, the species of Derris listed in this publication should bear the following names:
Deguelia benthamii (Thwaites) Blake.—*Derris benthamii* Thwaites, *Derris paniculata* Benth.
Deguelia chinensis (Benth.) Taub.—*Derris chinensis* Benth.
Deguelia elliptica (Wall.) Taub.—*Derris elliptica* (Wall.) Benth.
Deguelia heptaphylla (L.) Blake.—*Derris heptaphylla* (L.) Merr., *Derris sinuata* Benth.
Deguelia koolgibberah (F. M. Bailey) Blake.—*Derris koolgibberah* F. M. Bailey.
Deguelia malaccensis (Benth.) Blake.—*Derris malaccensis* Prain.
Deguelia negrensis (Benth.) Taub.—*Derris negrensis* Benth.
Deguelia oligosperma (K. Schum. and Lauterb.) Blake.—*Derris oligosperma* K. Schum. and Lauterb.
Deguelia philippinensis (Merr.) Blake.—*Derris philippinensis* Merr.
Deguelia polyantha (Perkins) Blake.—*Derris polyantha* Perkins.
Deguelia robusta (Benth.) Taub.—*Derris robusta* Benth.
Deguelia scandens Aubl.—*Derris guianensis* Benth.
Deguelia stuhlmannii Taub.—*Derris stuhlmannii* (Taub.) Harms.
Deguelia thyrsiflora (Benth.) Taub.—*Derris thyrsiflora* Benth.
Deguelia timoriensis (DC.) Taub.—*Derris scandens* (Roxb.) Benth.; not *D. scandens* Aubl.
Deguelia trifoliata (Lour.) Taub.—*Derris trifoliata* Lour., *Derris uliginosa* (Roxb.) Benth., *Derris forsteniana* Miq.
Derris pinnata Lour. is not now retained in the genus *Derris*, but is referred to Dalbergia as *Dalbergia pinnata* (Lour.) Prain, displacing the name *Dalbergia tamarindifolia* Roxb.
S. F. Blake.

As early as 1848, Oxley (*307*)[2] reported the use of tuba root (*D. elliptica*) as an insecticide.

The species of Derris which have been found by test to have insecticidal value are: *Chinensis* (*299*); *elliptica* (*276*); *heptaphylla* (*290*); *malaccensis* (*130*); *philippinensis* (*71*, *98*); *polyantha* (*71*, *290*); *thyrsiflora* (*130*); *uliginosa* (*trifoliata*) (*276*).

In addition, the following varieties of Derris in Malaya have been shown by Gater (*130*) to have insecticidal value: Tuba rimba, tuba merah, and tuba puteh, varieties of *D. elliptica;* tuba gagah, tuba standing, and tuba creeping (*Derris* sp.).

McIndoo, Sievers, and Abbott (*276*) report that the following species of Derris are ineffective as insecticides: *Koolgibberah*, *oligosperma*, *robusta*, and *scandens*.

Stockdale (*380*) states that tests are being made to determine the insecticidal value of *D. benthamii* from Ceylon.

The following species of Derris have been examined chemically: *Chinensis*, *elliptica*, *stuhlmannii*, and *uliginosa*.

Lenz (*246*) found the constituents of the roots of *Derris stuhlmannii* from German East Africa to be different from those of the roots of *D. elliptica* from New Guinea. Power (*320*) found the active principle of *D. uliginosa* to be a resin soluble in chloroform.

Rotenone is the most important insecticidal constituent of *chinensis* and *elliptica*. As a rule, dried *D. elliptica* root of a good grade contains from 2.5 to 6 per cent rotenone. It has also been isolated from the following plants belonging to genera other than Derris: *Lonchocarpus* (*154*, *p. 215; 404; 74*); *Milletia taiwaniana* Hayata (*23*); *Mundulea suberosa* Benth. (*154*); *Ormocarpum* (*154*). All these rotenone-containing plants belong to the family Fabaceae.

Rotenone is a white crystalline material which melts at 163° C. and has the empirical formula $C_{23}H_{22}O_6$. It is insoluble in water, readily soluble in chloroform, benzene, and acetone, and slightly soluble in ether, alcohol, and oils. A number of derivatives of rotenone have been prepared—for example, the oxime, phenylhydrazone, and hydrochloride. Rotenone contains a ketone (CO) group and two methoxyl (OCH_3) groups.

As yet too little is known of the constitution of rotenone to synthesize it.

Pure crystalline rotenone does not change on long standing, neither does it undergo any appreciable change in contact with water or petroleum oils. In solution in certain organic solvents, such as chloroform, ethylene dichloride, and pyridine, however, it decomposes rather rapidly, with an accompanying loss of toxicity. This decomposition takes place only very slowly in some solvents, for example, benzene and acetone. Rotenone is also sensitive to the action of alkalies. Emulsions made with the aid of certain organic solvents, such as chloroform, or with an alkaline emulsifying agent may lose their toxicity. Rotenone is best applied as a spray by suspending the dry powdered material in water.

Rotenone is both a contact and a stomach insecticide and promises to be effective against a wide variety of insect pests. Rotenone, rather than derris root or cube (*coo'bay*) root, should be employed in toxicity tests, as only by the use of pure compounds can the knowledge of insecticides be extended. Furthermore, Roark (*347*) has recently called attention to the fact that the rotenone content of derris root is extremely variable and some lots of derris contain no rotenone.

---

[2] Italic numbers in parentheses are the citation numbers.

The root of *Derris elliptica* contains a number of constituents in addition to rotenone. Among these the following predominate: Toxicarol, $C_{23}H_{22}O_7$, melting point 219° C., greenish yellowish hexagonal plates; tephrosin, $C_{23}H_{22}O_7$, melting point 198°, stout 6-sided colorless prisms; and deguelin, $C_{23}H_{22}O_6$, melting point 171°, pale green rodlike plates. *Cracca* (*Tephrosia*) *toxicaria* and *vogelii*, as well as cuba (*Lonchocarpus nicou*), also contain certain of these compounds. All these compounds contain two methoxyl groups and are related chemically to rotenone (*75*).

BIBLIOGRAPHY

ANONYMOUS. (1)

THE COLONIAL AND INDIAN EXHIBITION AT SOUTH KENSINGTON. THE STRAITS SETTLEMENTS. Pharm. Jour. and Trans. (3) 17: 4–7. 1886.

Among the herbarium specimens of guttapercha is one of the tuba plant, identified as *Derris elliptica.* The root of this plant, which is deserving of chemical and physiological investigation, is chiefly used by the natives for poisoning fish. It is pounded and thrown into the water, causing the fish to rise to the surface. They are then netted and speared. Oxley considers a decoction of the root of this plant to the best remedy known to him for killing the insect that infests the leaves of the nutmeg tree and causes them to turn yellow. The root has an extremely persistent acrid taste and would doubtless yield an active principle and might prove valuable as an insecticide.

——— (2)

DERRID. Pharm. Jour. and Trans. (3) 21: 559–560. 1890.

In the late colonial and Indian exhibition in London [1886], a plant was exhibited in the Straits Settlements court under the name of *Derris elliptica.* This plant was said to afford the most important of several drugs passing under the name of tuba root in that colony. The root possesses an extremely acrid taste, and like lobelia causes a flow of saliva, but ultimately there is a feeling of numbness of the tongue and palate and a lessened secretion of saliva, with the sensation of a thick tongue, affecting the speech. The natives of Java use it as a fish poison. In Borneo it forms an ingredient of the Siren arrow poison, and in the Straits Settlements of the Malay arrow poison called Ipoh.

——— (3)

POISONOUS PLANTS OF THE MALAY PENINSULA. Malay Peninsula Agr. Bul. 8. 1898.

Tuba, a low-climbing plant, is often cultivated for use as a fish poison. It is propagated by cuttings and grows fairly rapidly. It usually grows as a prostrate plant, the branches being allowed to straggle about on the ground. The roots are the parts used for poisoning fish, generally being pounded, mixed with lime and water, and thrown into a river or arm of the sea. The extract has long been used by the Chinese and other gardeners here as an insecticide, but of course it is unsafe to use on vegetables eaten uncooked (p. 217).

——— (4)

TUBA ROOT. Chem. and Drug 94 (2152): 41. (Index Folio 549) 1921.

For some years past [1921] tuba root has been mentioned in the list of drugs arriving at Liverpool, and in Perak it used to sell at about ·35 cents (Malayan) per catty or 9½ pence a pound. A brief description is given of the plant, its use as an insecticide, and of the work of Wray, Power, and others on the active principle.

——— (5)

BORNEO ARROW POISON AS AN INSECTICIDE. Science Sup. 58 (1491): X 1923.

Refers to the work of Fryer, Stenton, Tattersfield, and Roach (*118*) on the insecticidal properties of tuba root.

——— (6)

GENERAL CULTIVATION. Brit. Empire Exhibition, London, Malayan ser. 2, 13 p., illus. 1923.

"The Ministry of Agriculture and Fisheries, London, report that there is, as yet, no trustworthy information concerning the relative toxic contents of the different

ANONYMOUS—Continued.

species of Derris or of the varieties of the species of *Derris elliptica,* since botanic specimens have not been obtainable."

There is no doubt that derris has valuable insecticidal properties, and it is believed it will become a valuable commercial insecticide.

——— (7)

MISCELLANEOUS CROPS. Brit. Empire Exhibition, London, Malayan ser. 8, 49 p. 1924.

"Cultivation—Derris may be propagated readily by means of stem cuttings, eighteen inches long, planted in sandy soil. If exposed to the full sun, it is advisable to remove the leaves to prevent the stems from dying from excessive transpiration. Under light shade, the cuttings root earlier, often within six weeks from the date of planting.

"The method of cultivation adopted by Chinese market gardeners is to plant long cuttings, which have been twisted into a circle, at distances of about 6 feet apart, and allow the plants to ramble over the land. During growth, pig manure is applied to the soil. The crop is not harvested at one time, but roots are lifted as required.

"As a sole cultivation, the best results will be obtained by ridging the land. The ridges should be made three feet apart, the soil being worked into a fine tilth during the operation. Derris will grow in most soils, but is partial to a clayey loam containing a fair quantity of sand. The cuttings should be placed on the ridges at a distance of three feet apart, giving 4,840 plants to the acre.

"The roots mature according to cultural conditions, the average period of growth being two years. The weight of fresh roots obtained from a single plant is from one to two pounds, according to the distance of planting. The average weight of roots per plant obtained on the Experimental Plantation, Kuala Lumpur, was one pound and a loss of weight of 40 per cent took place during drying.

"The retail price of the root in the local market at the present time [Oct. 1923] is about 30 cents [Malayan] per kati (1 kati = 1⅓ pounds), the wholesale price being from 20 to 25 dollars [Malayan] per pikul [1 pikul = 133⅓ pounds]." [In United States currency these prices are equivalent to about 11 cents per pound retail or 7½ to 9½ cents per pound wholesale.] (p. 36–38.)

——— (8)

PLANT DISEASES AND PESTS. Brit. Empire Exhibition, London, Malayan ser. 9, 42 p. 1924.

"For small caterpillars and sucking insects, where a simple wash is required, the Derris spray can be made on the spot. Use the following proportions:—Derris root (4–5 lbs.), soap (2 lbs.), water (50 [imperial] gallons).

"Cut the derris root into small pieces and pound to a pulp in a mortar with a little water. Inclose the pulp in a cloth and squeeze well in a larger quantity of water. To the extract obtained by this process add the soap, which has been dissolved in a little hot water. Then dilute to 50 gallons."

——— (9)

SUMATRA DERRIS ROOT. Fertilizer, Feeding-Stuffs and Farm Supplies Jour. 11: 663–664. 1926.

Gives an account taken from a report by Consul Sidney B. Redecker (*325*).

——— (10)

FIGHTING THE STALKBORER. Farming in South Africa 2 (14): 76. 1927.

Describes experiments in which Doctor Ripley, of the Cedara School of Agriculture, early in the season treated young maize plants on 40 small plots with five different chemicals for the purpose of finding out how much burning through top-dressing maize plants can stand without reducing the yield. Details of the experiments are not published, but it is concluded that considerable burning by some of the chemicals will have no appreciable effect upon the yield. Reports that the sheep dip, Kymac (which contains derris extract), has proved safe at a dilution of 1 in 200.

——— (11)

NEOTON. WHAT IT MEANS TO AGRICULTURISTS. Inst. Phys. and Chem. Research, Tokyo, 12 p. [1927.]

"How to prepare neoton for use.—Although the proportion of neoton may be adjusted to suit the nature of the particular insect to be dealt with, the standard proportion of ingredients as fixed by our chemists is as follows: Neoton, 0.5 pound; soap (fish oil soap is most suitable), 1 pound; water, 40 [imperial] gallons.

"Procedure.—Heat 1½ gallons of water to about 60° C., add the soap, stirring constantly, and when all the soap is completely dissolved stir in the neoton. A vigorous stirring will bring about a homogeneous emulsion very quickly. Lastly, add remainder of the water.

"How to use.—It is used as a spray. This emulsion is not to be kept any length of time as the active principle, rotenone, loses its strength by undergoing a chemical change when in contact with water. It is best to mix one day's requirement at a time. Our experiments show that emulsion of rotenone does not keep its original effectiveness longer than two days."

The external or contact action of neoton is effective against the following insects: Sawflies (larva); leaf beetles (imago and larva); plant lice (larva and imago); tussock moths (larva); geometers (larva).

"Effect on insect ova.—A solution of 1 pound of Neoton in 40 [imperial] gallons of water was sprayed on ova soon after they were laid and kept from the rain.

ANONYMOUS—Continued.

The percentages of deaths are as follows: Ova of Chilo simplex, 60 per cent; ova of Illiberis pruni, 15.1 per cent; ova of Naraga aenescens, 4.6 per cent; ova of Phaedon brassicae, 21.6 per cent.

"From these experiments it is concluded that the contact action of Neoton is very effective.

"Used in proportions ranging from ¼ to 2 pounds to about 40 imperial gallons of water, Neoton was effective against the following insects: Pear aphis; cabbage aphis; chrysanthemum aphis (*Aphis cardui*); apple woolly aphis; rose aphis; *Aphis rumicis;* arrowhead aphis; plum aphis; pear psylla; pear bagworm larvae; pear sawfly larvae (Hoplocampa); Pterochlorus tropicalis; Euproctis conspersa larvae; Phalera flavescens; Diacricia subcarnea larvae; Japanese tent caterpillar; larvae of Cameria geometer; Podops lurida (imagines and 3d and 5th instars); rush sawfly larvae; Illiberis pruni larvae; Aulacophora femoralis imagines; Rhynchites heros imagoes; arrowhead budweevil; Echinocremus bipunctatus larvae and imagoes; Phaedon brassicae imagoes and larvae; rose sawfly larvae; ticks on calves and pigs; chicken lice; grasshoppers; strawberry beetle larvae; caterpillars (species not given); red spider. Neoton was also effective in the treatment of sarna or kräze, an acute skin disease of cattle in Argentina. One pound of Neoton in 24 imperial gallons of water had no effect on cutworms" (p. 1–12).

——— (12)

ORGANIC INSECTICIDES. Chem. and Drug 108: 427. 1928.

Refers to the work of Tattersfield and Gimmingham with certain insecticidal plants. *Derris elliptica* and haiari from Britsh Guiana have yielded a poisonous, colorless, crystalline substance, tubatoxin, which is excessively poisonous to insects.

——— (13)

TUBA (DERRIS) ROOT AS INSECTICIDE. Indus. Chem. 5: 268. 1928.

Three types of root are under trial at the Government experimental plantation, Serdang, Federated Malay States. The bulletin of the Imperial Institute has stated that work is in progress to determine the relative value of these different types in the preparation of insecticides. A comparison is being made of the results obtained at Rothamsted by the use of dry partly aged roots with the results obtained here by the use of fresh aqueous extracts from roots of known history.

——— (14)

DERRIS-ROOT POISON IS SPEEDY AND SAFE. Amer. Fruit Grower 49 (4): 7. 1929.

Reference is made to the investigation being made on the structure of rotenone in the United States Department of Agriculture by F. B. LaForge.

——— (15)

RECENT RESEARCH ON EMPIRE PRODUCTS. Miscellaneous Agricultural Products. Bul. Imperial Inst. [London] 27: 507. 1929.

"The Acting Agricultural Chemist (of the Federated Malay States) reports the results of experiments showing in *Derris elliptica* a definite reduction in the amount of ether extract when the roots are allowed to remain for 25 months before harvesting. The roots should therefore be collected between 21 and 23 months after planting. Preliminary experiments with *D. malaccensis* (Erect Sarawak) show that the amount of ether extract from this variety of Derris is greatly in excess of that from *D. elliptica*, the comparative figures for five roots of the same age (23 months), calculated on a moisture-free basis, being as follows: *D. elliptica*, 9.7 per cent, *D. malaccensis*, 34.2 per cent."

——— (16)

ROTENONE INVESTIGATED BY DEPARTMENT. U. S. Food, Drug, and Insecticide Admin. Food, Drug, and Insecticide Rev. 13: 138. 1929.

Department of Agriculture chemists are now investigating the possibility of utilizing rotenone, the deadly poison derived from derris roots, as a safe spray for apples, pears, grapes, and vegetables. Its use as a fruit spray would make unnecessary the present expensive machinery for washing sprayed fruit.

——— (17)

FROM THE DISTRICTS. TUBA ROOT AND CHILLIES. Malayan Agr. Jour. 18: 113–115. 1930.

"Some interesting figures are presented relating to the cultivation of tuba, with chillies as a catch crop, in the district of Kinta. The tuba yielded 12 pikuls [1.602 pounds] an acre after 18–24 months, and the produce was sold locally, ungraded, for from $16 to $20 a pikul or from 32–40 cents a kati [equivalent to about 13½ to 17 cents United States currency per pound]. The chillies yielded from 80 to 100 katis an acre after four months, and were sold locally for from 24 to 30 cents a kati."

——— (18)

NATIVE FISH-POISONS AS INSECTICIDES. Nature [London] 125 (3145): 218. 1930.

Refers to the work of Tattersfield (*403*) with white and black haiari. These plants are being experimentally cultivated in British Guiana. *Tephrosia toxicaria,*

ANONYMOUS—Continued.

T. macropoda, and *Cocculus indicus* are mentioned as possessing both fish-poisoning and insecticidal properties.

——. (19)
ENTOMOLOGICAL NOTES. Malayan Agr. Jour. 18: 512–513. 1930.

A chrysomelid beetle, tentatively identified as *Neolepta biplagiata* Jacoby, has been responsible for considerable damage to the leaves of derris. The eggs, larvae, and pupae are found in the soil. The beetle is about three-sixteenths of an inch in length. The beetle readily succumbs to a spray consisting of pyrethrum powder. 1.67 pounds; soap, 1.67 pounds; petroleum, 0.8 imperial gallon; and water, 40 imperial gallons. This quantity is considered to be sufficient for 1 acre. Tuba, used at the rate of 1 pound to 10 imperial gallons of water, is a good insecticide for general use in the garden, as plants regularly sprayed will be kept comparatively free from mealy bugs, thrips, aphids, and similar insects.

——. (20)
FROM THE DISTRICTS. Malayan Agr. Jour. 18: 516. 1930.

An estate in Pahang now has 1,050 acres planted with tuba and other crops from which insecticides can be prepared.

——. (21)
NEW INSECTICIDE PRODUCED BY CUBE ROOTS. Sci. Amer. 143: 390–391. 1930.

A brief review of the article by Roark (*344*) on the American market for tuba root.

ANDREWS, E. A. (22)
RED SPIDER. Indian Tea Assoc., Sci. Dept. Quart. Jour., pt. 4: 206–219. 1928.

Red spider (*Tetranychus bioculatus*) which infests tea may sometimes be found on Boga medeloa (*Tephrosia candida*) and on *Derris robusta*, as well as on many jungle plants.

ATSUMI, K., and SHIMADA, M. (23)
MILLETIA TAIWANIANA and DERRIS ELLIPTICA, TOXIC PRINCIPLE OF WHICH IS ROTENONE. Jour. Pharm. Soc. Japan no. 500, p. 739. [Abstract in Yearbook Pharm. [London] 1924: 209.]

The authors state that Nagai, who investigated the plant in 1902, isolated rotenone. Subsequently, in 1917, Hayata and Ishikawa found anhydroderrid in the mother liquor of rotenone. They considered the latter to be closely allied to, but not identical with, tubatoxin from *Derris elliptica*. The authors have reinvestigated the subject and have established the identity of the two substances, consequently the name tubatoxin is abandoned, and the prior name rotenone retained for the crystalline toxic principle of both *Milletia taiwaniana*, Hayata, and of *Derris elliptica*. It has the empirical formula $C_{18}H_{18}O_5$ and occurs in rhombic plates or needles. The melting point is 163° C. The oxime has the melting point 236.5° to 244°, and the phenylhydrazone has the melting point 255°.

AUBLET, M. F. (24)
HISTOIRE DES PLANTES DE LA GUIANA FRANCOISE. v. 2, p. 623–976. London. 1775.

Gives a botanical description of *Deguelia scandens* from French Guiana. (Deguelia Aubl.=Derris Lour.) (p. 750–753).

BACK, E. A., and COTTON, R. T. (25)
THE CONTROL OF MOTHS IN UPHOLSTERED FURNITURE. U. S. Dept. Agr. Farmers' Bul. 1655, 33 p., illus. 1931.

To meet the need for prevention of reinfestation of upholstered furniture by clothes moths after fumigation, a number of moth-proofing solutions are now available. The most effective of them are the fluoride, cinchona alkaloid, and rotenone solutions (p. 30).

——, COTTON, R. T., and ROARK, R. C. (26)
ROTENONE AS A MOTH-PROOFING AGENT. Jour. Econ. Ent. 23: 1014. 1930.

Acetone containing only 0.05 per cent rotenone gave excellent protection to woolen goods thoroughly impregnated with the solution, against *Tineola biselliella* Hum., *Anthrenus vorax* Casey, and *Attagenus piceus* Oliv. Rotenone appears to equal any proprietary moth-proofing solution now offered the public in imparting moth resistance to fabrics.

BAGNALL-BULL, E. (27)
IMPROVEMENTS RELATING TO INSECTICIDES, VERMIFUGES, SHEEP DIPS, AND THE LIKE. Brit. Patent 214822, issued May 1, 1924; applied for April 16, 1923.

The patentee claims a method of obtaining derris extract for use as an insecticide, vermifuge, sheep dip, or the like, which consists in breaking or crushing the fresh roots or other portions of the plants of the family known botanically as Derris or Tuba, treating them with water so as to obtain a milky emulsion or suspension of the juices containing toxic properties, and then separating the emulsified substance from the whole or a part of the water.

BAGNALL-BULL, E.—Continued.

To separate the emulsified substance from the water, evaporate the whole or a part, preferably in vacuo, thereby obtaining a paste of a consistency suitable for transport, or add to the milky emulsion milk of lime, which coagulates or precipitates the emulsified substance. Free the precipitate obtained by the last method from excess moisture by evaporation, by filtration, or by centrifugalizing. Or mix it with tartaric acid or any other suitable acid in quantity equivalent to the amount of lime contained in the precipitate. Or the milky emulsion may be rendered alkaline with soda carbonate, to which is then added a brine or salt solution in a quantity sufficient to salt out the emulsified substance, which then precipitates. The emulsified substance or precipitate so obtained is then dried and ground or can be used in a moist condition according to the use to which it is to be applied. Grinding produces a powder, which by reason of its fineness admits of a suspension of the drug in water. This preparation alone or mixed with inert powder may be used as a dusting powder, or it may be mixed with soap, sulphur, or other suitable substance for use as insecticidal washes, sheep dips, or for spraying, either as a powder or when mixed with water.

——— (28)

INSECTICIDE, VERMIFUGE, SHEEP DIP AND THE LIKE. U. S. Patent 1522041, issued January 6, 1925; applied for July 22, 1924.

The same as British Patent 214822 (27).

BAILEY, L. H. (29)

STANDARD CYCLOPEDIA OF HORTICULTURE. Ed. 3, v. 2, 1,200 p., illus. New York. 1919.

The author claims that the 40 species of Derris are of little horticultural significance. *Derris scandens* is described and is said to have been offered for sale in California, but has not been successfully cultivated (p. 988).

BANFIELD, E. J. (30)

THE CONFESSIONS OF A BEACHCOMBER. 336 p. illus., London and Leipzig. 1908.

Derris scandens is called Paggarra and "wild dynamite" in tropical Queensland. The bruised strands and leaves stupefy fish, but the effect is only temporarily soporific (p. 270–271.)

BATES, H. W. (31)

THE NATURALIST ON THE RIVER AMAZON. v. 2, 417 p., illus., London. 1863.

The milky juice from the liana called timbo (*Paullinia pinnata*) is used for stupefying fish in pools. The poison acts by suffocating the fishes (p. 82–83).

BENTHAM, G. (32)

SYNOPSIS OF DALBERGIEAE, A TRIBE OF LEGUMINOSAE. Jour. Linn. Soc. Sup. 4, 1,200 p., illus. London. 1860.

On pages 101 to 115 is given a botanical description of 34 species of Derris, including *uliginosa* and *elliptica*.

——— (33)

FLORA AUSTRALIENSIS: A DESCRIPTION OF THE PLANTS OF THE AUSTRALIAN TERRITORY. v. 2, 521 p. London. 1864.

Describes *Derris uliginosa* from Australia (p. 272–273).

——— and HOOKER, J. D. (34)

GENERA PLANTARUM. v. 1, 1,040 p. London. 1862–67.

There are 35 species in the genus Derris, found mostly in tropical Asia (p. 549).

BIRKINSHAW, F. (35)

FIELD DIVISION—ANNUAL REPORT FOR 1927. Malayan Agr. Jour. 16: 141–160. 1928.

During 1927 the area under tuba increased in Johore. There were about 1,400 acres under crop. Two companies were growing it on a comparatively large area, and further extensions were anticipated during the next few years.

BISHOP, R. O. (36)

DIVISION OF CHEMISTRY—ANNUAL REPORT FOR 1927. Malayan Agr. Jour. 16: 109–113. 1928.

States that a study of the insecticidal value of different varieties of tuba has been started in collaboration with the Government entomologist. The method established at Rothamsted of evaluating the dry root by its ethereal extract is being investigated with a view to determining how the percentage of ether extract is related to the toxicity of aqueous extracts of the fresh root. A simple means has been found for separating the toxic bodies from aqueous extracts of the fresh root, and it appears desirable to study the physical properties of these before deciding the insecticidal merits or demerits of any particular variety of tuba.

BISHOPP, F. C. (37)
FLEAS AND THEIR CONTROL. U. S. Dept. Agr. Farmers' Bul. 897, 16 p., illus. (Revised 1926.) 1915.

Experiments with the use of the powdered roots of certain tropical plants known as derris indicate that this drug when fresh is exceedingly effective in destroying fleas on animals. All fleas on a dog will be destroyed by one application of 1 gram, or about three-fourths of a level teaspoonful, of the powder. It is suggested that the material be mixed at the time it is used with two parts of flour or cornstarch and dusted with a shaker into the hair of the animal, especially along the back and neck (p. 11).

——— (38)
THE PIGEON FLY—AN IMPORTANT PEST OF PIGEONS IN THE UNITED STATES. Jour. Econ. Ent. 22:974–980. 1929.

A number of insecticides have been tested on squabs and pigeons for the destruction of the flies. Some have been found very effective. One of the most effective and easily applied treatments is fresh pyrethrum powder. One to three pinches of the powder, depending upon the size of the squab, should be scattered among the feathers. This will destroy all flies present. Pyrethrum powder is less effective when used on grown birds, but a thorough dusting kills a large percentage of the flies present.

Derris powder and tobacco powder containing about 6 per cent nicotine, used in the same way, were nearly as effective. Two proprietary extracts of derris root used at the rate of one-half ounce and 2 ounces to the gallon also gave a complete kill. The slight staining of the feathers from the pyrethrum extract, especially on white birds, might be somewhat objectionable. This staining is not caused by the derris products.

———, LAAKE, E. W., and WELLS, R. W. (39)
IMPORTANT BIOLOGICAL FACTS ON THE OX-WARBLE CONTROL. Jour. Econ. Ent. 15: 264–265. 1922.

Gives an account of the discussion following the reading of this paper. A single application of derris in soapy water applied with a brush to the backs of infested animals has been found to kill almost 100 per cent of Hypoderma larvae.

———, LAAKE, E. W., WELLS, R. W., and PETERS, H. S. (40)
EXPERIMENTS WITH INSECTICIDES AGAINST CATTLE GRUBS, HYPODERMA SP. Jour. Econ. Ent. 23: 852–863. 1930.

Excellent results were obtained in tests made against Hypoderma larvae in the backs of cattle with powdered cube root, powdered derris root, derris extract in kaolin, derris resins in petrolatum, and a proprietary derris extract ointment.

No toxic effects on the cattle are to be expected from derris products, and they seem to have no deleterious influence on the skin. Derris powder from which the rotenone had been extracted with ether killed 33 per cent of the grubs, indicating that the other constituents have insecticidal value. Kaolin containing not less than 2 per cent pure rotenone gave almost a complete kill.

BLAKE, S. F. (41)
ON THE NAMES OF CERTAIN SPECIES OF DEGUELIA (DERRIS). Jour. Wash. Acad. Sci. 19: 472–475. 1929.

Suggests that the following species of derris be transferred to the genus Deguelia: *Benthamii, heptaphylla, koolgibberah, malaccensis, oligosperma, philippinensis,* and *polyantha.*

BLANCO, M. (42)
FLORA DE FILIPINAS, SEGUN EL SISTEMA SEXUAL DE LINNEO. 887 p. Manila. 1837.

On pages 558–559 is given a botanical description of three species of Galedupa, *G. pungam, G. maculata* (*manchado*), and *G. frutescens.* (Certain species of Galedupa are now transferred to derris.)

BLEEKER, P. (43)
VERGADERINGENDEER NATUURKUNDIGE VERSENIGING IN NEDERLANDSCH-INDIE. Natuurk. Tijdschr. Nederland.-Indie. 16: 3–11. 1858.

The author exhibited a sample of akar tuba, the root of *Dalbergia heterophylla* Wld., used as a fish poison, at a meeting held August 27, 1857.

BLIECK, L. DE, and BAUDET, E. A. R. F. (44)
BESTRIJDING DER HYPODERMA. [Measures against Hypoderma.] Tijdschr. Diergeneesk. 54:454–457. 1927. [Abstract in Rev. Appl. Ent. (B) 15:211. 1927.]

Excellent results against Hypoderma on cattle have been obtained by rubbing paradichlorobenzene or derris powder into the warbles. Each is used at 10 per cent strength, the former mixed with vaseline and the latter with liquid paraffin.

BLUME, C. L. (45)

BIJDRAGEN TOT DE FLORA VAN NEDERLANDSCH INDIE. v. 1, 577 p. Batavia. 1825.

In a footnote on page 41 the root of *Dalbergia heterophylla*, called tuba aroij, is mentioned as a fish poison.

BOEHRINGER, C. H. (46)

DERRIS (TUBA) ROOT PRODUCTION IN STRAITS SETTLEMENTS. U. S. Dept. Com., Bur. Foreign and Dom. Com., World Trade Notes on Chemicals and Allied Products 4 (15) : 11–12. 1930.

The Chinese colonists at Sibu, Sarawak, who have planted 4,000 acres of derris, estimate a production in 1931 of 600 tons of derris root of good quality.

Early in 1929 the largest British buyer of derris root in Sarawak paid as high as S$27 per picul (133½ pounds) for root in the open market, but in view of large areas coming into bearing the price has now been reduced to S$6. (Straits Settlements dollar equals about $0.56 United States currency.) However, producers are reluctant to sell at this figure. It is estimated that derris probably could be produced at a fair profit on a large scale at approximately S$10 to S$15 per picul. Since derris carries an export tax of 20 per cent in Sarawak, it is believed that it would not be possible to quote anything less than $100 United States currency per short ton, export duty paid f. o. b. Sarawak, on the basis of an initial price of S$15 per picul, or landed in New York for approximately $120 a ton for the raw material (equivalent to approximately 200 pounds of the extract.) The quantity of derris required for 1 pound of insecticide is not believed to be worth more than one-seventh of a cent.

It is thought that an abundant supply of the raw material will be available as soon as an outlet is developed.

——— (47)

DERRIS (TUBA) ROOT AND CHAULMOOGRA CULTIVATION AT THE MALAYAN AGRICULTURAL EXPERIMENTAL STATION. U. S. Dept. Com., Bur. Foreign and Dom. Com., World Trade Notes on Chemicals and Allied Products 4 (25) : 10. 1930.

The Malayan Agricultural Experiment Station at Serdang has considerable land under tuba root and is offering cuttings for sale at the rate of S$1.50 per 100, to be planted 3 by 3 feet apart, or at the rate of 4,480 plants per acre. The director of the station stated that an estate in Pahang, under the operation of McDougall & Co., is growing tuba root exclusively for marketing in the United Kingdom. Guthrie & Co. (Ltd.), is also growing tuba root on its rubber plantations in Johore. Another contact of the bureau's Singapore office quoted tuba root at S$30 per picul, dry, packed, and duty paid, f. o. b. Sibu. In United States currency this is equivalent to $12.58 per 100 pounds.

BOERLAGE, J. G. (48)

HANDLEIDING TOT DE KENNIS DER FLORA VAN NEDERLANDSCH INDIË. v. 1, 703 p. Leiden. 1890.

Gives a botanical description of the genus Derris Lour., of which there are 35 species (p. 387–388).

BOJER, W. (49)

HORTUS MAURITIANUS OU ENUMÉRATION DES PLANTES EXOTIQUES ET INDIGÈNES, QUI CROISSENT A L'ILE MAURICE, DISPOSÉES D'APRÈS LA MÉTHODE NATURELLE. 456 p. Maurice. 1837.

Gives a botanical description of six species of Dalbergia found in Mauritius.

BOURCART, E. (50)

INSECTICIDES, FUNGICIDES, AND WEED KILLERS. Translated by T. R. Burton. English ed. 2, 431 p., illus. London. 1925.

Tests by De Ong and White (*98*) are described. A spray containing 1 pound of derris, 10 imperial gallons of water, and 5 ounces of soft soap is effective against aphids infesting tobacco in Sumatra. The derris roots, which may be dry or fresh, are cut into small pieces, placed in a little water, and then pounded into a paste, which is diluted with a gallon of water and left standing overnight in a wooden vat. An iron container must not be used. The dregs are then pressed, and all the fluid is strained through a cotton cloth. The resultant concentrate is a milk-white solution, which keeps for a few days only. It is diluted with nine parts water for spraying. About 16 imperial gallons of solution are needed for 1,000 tobacco plants that have been 25 to 30 days in the field. Twice this quantity is needed for full-grown plants. If derris roots are to be stored, they must be kept dry (p. 412–413).

BOWER, R. E. B. (51)

DERRIS ROOT IN GOOD DEMAND, SUPPLY LIMITED, SINGAPORE. U. S. Dept. Com., Bur. Foreign and Dom. Com., World Trade Notes on Chemicals and Allied Products. 4(29) : 10. 1930.

The supply of derris received at Singapore is somewhat irregular. Derris grows wild in Borneo, but it is understood that practically all the supply from that source is contracted for in London. There are about 500 acres under cultivation in the Federated Malay States and 600 acres under cultivation in Johore, one of the

Bower, R. E. B.—Continued.

unfederated Malay States. Small quantities of derris from these sources reach Singapore from time to time. However, the Malayan trade is so limited that imports and exports of derris are not listed separately in the official returns.

The price of derris varies widely, but it is usually relatively high, owing to the good demand and limited supply. Native sellers have received as much as $0.24 United States currency per pound for the untreated roots, but Singapore buyers can generally purchase the product at a lower figure, ranging from $0.10 to $0.12 per pound.

The roots are generally shipped in the rough form at present, although exporters are seeking some method of reducing the bulk of such shipments without lowering the toxic qualities of the roots. Cutting them into small pieces has been tried, but it has been found that the resulting loss in toxic value makes this method of shipment unsatisfactory. Thus far, no suitable means have been found for extracting the poison from the roots before shipment.

Braddock, D. M. (52)

THE DEMAND FOR TOBACCO INSECTICIDES IN THE EAST COAST OF SUMATRA. U. S. Dept. Com., Bur. Foreign and Dom. Com., Spec. Circ. 305, 4 p. 1930.

Tuba extract prepared by the experimental station and supplied to the planters at cost is used on practically all the tobacco estates for combating aphids. Nicotine is not so satisfactory. Most of the derris is imported from the Straits Settlements, although a small quantity is cultivated in North Sumatra. Some tuba extract has also been imported from Germany and Japan.

——— (53)

DERRIS ELLIPTICA (TUBA ROOT) PRODUCTION IN NORTH SUMATRA MAY BE DISCONTINUED. U. S. Dept. Com., Bur. Foreign and Dom. Com., World Trade Notes on Chemicals and Allied Products 4(20) : 11. 1930.

The director of the Deli Proefstation stated his belief that derris could be grown in either a tropical or subtropical climate; no purpose, however, would be served in obtaining seeds; and indeed, strong doubt is felt as to the possibility of exporting derris seeds from Sumatra in view of the Government restriction on the exportation of various plant seeds. In Sumatra plantings have been made from the roots.

Derris roots shrivel and lose a considerable portion of their strength in the course of a long ocean voyage. For this reason exporters are unable to guarantee the chemical strength on arrival at destination.

The one producing estate has had a prosperous year and has recently sold derris at a price competitive with the Singapore root. It is reported, however, that this estate is to be discontinued this year, as tuba root proves detrimental to the soil and constitutes a danger to adjacent rubber plantations. No plans for cultivating in other areas of northern Sumatra have been made. Large quantities of the root are still grown in the Straits Settlements.

Brandis, D. (54)

INDIAN TREES. 767 p., illus. London. 1906.

Twenty species of derris, including *uliginosa* from India, are described (p. 240–243).

Brittain, W. H. (55)

EXPERIMENTS IN THE CONTROL OF THE CABBAGE MAGGOT (CHORTOPHILA BRASSICAE BOUCHE) IN 1920. Ent. Soc. Nova Scotia. Proc. (1920) 6: 54–73. 1921.

Describes experiments in which a 50–50 mixture of derris with clay and derris solution at two strengths (1½ and 3 pounds to 100 imperial gallons) were applied to cabbage plants for the control of cabbage maggot (*Chortophila brassicae* Bouche).

The clay-derris mixture was applied at the rate of 960 pounds per acre, at a cost of $435.70 per acre. The derris solutions were applied at the rate of 10 and 20 pounds of derris with 650 imperial gallons water per acre, at a cost of $19.20 and $27.90 per acre. Derris costs 87 cents per pound. All the derris treatments protected the plants.

Pure derris powder applied to cabbage plants destroyed 4 per cent of the plants in two tests.

Derris (3 pounds to 100 imperial gallons) poured about plants previously infested with 25 fully grown cabbage maggots of the first brood prevented none of the larvae from pupating.

Onion maggot larvae (*Hylemia antiqua* Meig.) immersed for five seconds in derris solution (3 pounds derris to 100 imperial gallons) and then allowed to remain unmolested 1 week upon the food plant were affected as follows:

Age of larvae	Percentage dead or missing in one week	Age of larvae	Percentage dead or missing in one week
1 day	100	10 days	35
4 days	100	15 do	25
7 do	100	Full grown	0

——— (56)

FURTHER EXPERIMENTS IN THE CONTROL OF THE CABBAGE MAGGOT (CHORTOPHILA BRASSICAE BOUCHE) IN 1921. Acadian Ent. Soc. Proc. (1921) 7: 49–71. 1922.

When derris (3 pounds to 100 imperial gallons water) was applied to cabbage plants (Copenhagen Market variety), 39 per cent of the plants were destroyed by

Brittain, W. H.—Continued.

maggots, resulting in an estimated loss of $33.15 per acre. The derris cost 87 cents per pound.

In another test 2 pounds of derris to 100 imperial gallons of water permitted about 29 per cent of the plants (Early Jersey Wakefield variety) to be destroyed. The cost of treatment was $52.42 per acre.

Tests in which 3 pounds of derris to 100 imperial gallons were used permitted from 45 to 80 per cent of the plants (Early Jersey Wakefield variety) to be destroyed by maggots.

On radishes, derris (3 pounds to 100 imperial gallons) allowed 71 per cent of the plants to be infested. Corrosive sublimate was the only treatment that gave satisfactory control.

"Only one material, viz. derris, has proven very ineffective. As it is from the same lot of material used last year with fair results, we can only assume that it has deteriorated in storage" (p. 41).

About two-fifths pint of liquid and five-ninths ounce of dust was applied per plant.

——— (57)

SOME MISCELLANEOUS INSECTICIDE TESTS. Acadian Ent. Soc. Proc. (1924) 10: 23–42. 1925.

Describes insectary feeding tests made in Fiske trays with potato-beetle larvae. In this series arsenate of lead (paste) in the strength of 2 pounds to 40 imperial gallons is compared with various contact poisons, namely, nicotine sulphate, fish-oil soap, and derris powder, an attempt being made to use the last both as a contact insecticide and as a stomach poison. For the first (B) the insects were placed in a wire basket and dipped in the solution and then drained and fed on unsprayed leaves. For the second (A) the leaves were dipped in the solution and fed to the insects. The experiments lasted for a week, daily records being taken. The most notable results of the tests were those obtained in the case of derris, which in all strengths, ranging from 3 pounds to 100 imperial gallons to 1 ounce to 100 imperial gallons, and with both methods, destroyed 100 per cent of the insects, including half-grown grubs, fully grown grubs, and adults. It seems certain that this material did not act as a stomach poison, because the beetles were found dead in the A trays, with no sign of any feeding.

The extreme toxicity of this material to potato beetles is shown by the fact that one week after this experiment was concluded a number of last-instar grubs were placed upon untreated leaves in a tray. The next morning the insects were found dead in the bottom of the tray without ever having fed upon the leaves. On investigation it was found that this tray had been used in the previous week's test for one of the derris treatments (1 ounce to 100 imperial gallons). Evidently sufficient solution had been taken up by the cheesecloth bottom of the tray to cause the death of the insects. In comparing these results with field tests it would appear that the material is much more effective under insectary conditions.

Field tests to control aphids (*Cavariella* sp.) on parsnips were made with derris (2½ pounds and 4 pounds soap powder per 100 imperial gallons) and a commercial preparation of derris, Polvo (2½ pounds per 100 imperial gallons). Derris root (Polvo) reduced the infestation very little even when soap was added. The same materials were used under insectary conditions with similar relative results. Derris was of no value against fall-webworm larvae (*Hyphantria cunea*). Mature cabbage-maggot larvae immersed for five seconds in a suspension of derris root (3 pounds to 100 imperial gallons) and then placed upon their food plant were unaffected, whereas a 1—1,000 mercuric chloride solution killed 10 per cent. A similar test was made upon onion maggots (*Hylemyia antiqua*). The results are as follows:

Age of maggot	$HgCl^2$ (1–1,000 solution), per cent mortality	Derris (3 pounds in 100 imperial gallons water), per cent mortality
1 day	100	100
4 days	100	100
7 days	100	100
10 days	75	35
15 days	50	25
Ready to pupate	20	0

The following derris treatments gave perfect results in the control of head lice (*Lipeurus heterographus* Nitzch) on young chicks:

Derris, 1 part, plus 3 parts vaseline; 11 drams per 100 chicks.

Derris powder; 16 drams per 100 chicks.

Derris, 1 ounce, 1 gram calcium caseinate, and 8 imperial gallons water. The birds were rapidly immersed in the fluid and the feathers ruffled.

BROOKE, G. E. (58)

MEDICO-TROPICAL PRACTICE. A Handbook for Medical Practitioners and Students. Ed. 2, 522 p., London. 1920.

Decoctions of *Derris elliptica* have been used criminally and for suicide, but as large quantities are required, it is seldom used (p. 420).

BROWN, W. H. (59)

MINOR PRODUCTS OF PHILIPPINE FORESTS. Philippine Bur. Forestry Bul. 1, no. 22. 1921.

One of the commonest woody vines in the Philippines is *Derris trifoliata* Lour. (*D. uliginosa* Benth.) (p. 24).

——— (60)

POISONOUS PHILIPPINE PLANTS. MINOR PRODUCTS OF PHILIPPINE FORESTS. Philippine Bur. Forestry Bul. 3, no. 22. 1921.

Derris elliptica and *D. philippinensis* are listed among poisonous Philippine plants. The roots of both species are used to poison fish. Cattle have died from eating both plants (p. 79).

BUCKINGHAM, D. E. (61)

ACTION OF ROTENONE UPON MAMMALS WHEN TAKEN BY MOUTH—PRELIMINARY REPORT. Indus. and Engin. Chem. 22: 1133–1134. 1930.

When administered by mouth, pure rotenone produced no visible effects on dogs, cats, pigs, sheep, or chickens. The doses for dogs were up to 1 grain per pound of body weight. It is believed that even larger doses would be harmless. Derris extract (the ether extract of derris root evaporated to dryness) when administered by mouth was likewise without effect upon dogs and cats.

BUNTING, B. (62)

DIVISION OF AGRICULTURE—ANNUAL REPORT FOR 1927. Malayan Agr. Jour. 16: 92–108. 1928.

Investigations were undertaken during the year [1927] with two species of Derris, namely, *D. elliptica* (tuba puteh) and *D. malaccensis* (tuba merah), which are commonly cultivated in Malaya for export. Fresh samples of these two species were periodically forwarded to the agricultural chemist for examination, and material was prepared by him for insecticidal trials, which were carried out in the entomological laboratory in collaboration with the entomologist. Inquiries were received from home for tuba root, but supplies were not forthcoming locally, although as much as 25 cents [Malayan currency] per pound f. o. b. Singapore or Penang was offered for fine dry root. The results of numerous examinations of tuba root produced at Serdang so far indicate that the very fine roots have the highest toxic content and also that the crop should be harvested within a period of one and one-half to two years from planting, otherwise the root begins to lose its toxicity.

——— (63)

RECENT RESEARCH ON EMPIRE PRODUCTS, MISCELLANEOUS PRODUCTS. Bul. Imp. Inst. [London] 27: 219–220. 1929.

Bunting states that results of the experiment to ascertain the optimum age at which to harvest tuba puteh (*Derris elliptica*) are not yet complete. The dried roots of tuba puteh obtained from this experiment have been sold locally for export to London.

"A similar experiment has been started with 'Tuba Merah' (*D. malaccensis*).

"Further areas of both *D. elliptica* and *D. malaccensis* have been planted for future observations.

"Preliminary experiments with *Derris elliptica* indicate that this variety should be harvested about twenty-three months after planting, the ether extract of the roots reaching a maximum after this period."

The author calls attention to the half-yearly report published in the Bulletin of the Imperial Institute, v. 26, p. 222, 1928, in which the Malay name for *Derris elliptica* should read tuba puteh and not tuba merah, as printed, and that of *D. malaccensis* should be tuba merah, and not tuba puteh.

BUTENANDT, A. (64)

ÜBER DAS ROTENON, DEN PHYSIOLOGISCH WIRKSAMEN BESTANDTEIL DER DERRIS ELLIPTICA. Ann. Chem. 464: 253–277. 1928.

Previous work on the chemical constitution of rotenone is reviewed. The following data are given: Rotenone, $C_{23}H_{22}O_6$, melting point 163°, is oxidized by chromic acid to rotenonone, $C_{23}H_{20}O_7$ melting point 298° C. By the action of hydrogen and a platinum catalyst, rotenonone is reduced to perhydrorotenone, $C_{23}H_{26}O_6$, melting point 265°. By potassium permanganate, rotenone is converted to dehydrorotenone, $C_{23}H_{20}O_6$, melting point 218°, yellow crystals. Potassium hydroxide, or potassium hydroxide and zinc, convert dehydrorotenone to an acid, $C_{23}H_{24}O_8$, melting point 152°, the monoxime of which melts at 140°. By the action of hydrogen and platinum as a catalyst, this acid is converted to a compound, $C_{23}H_{26}O_8$, melting point 168°. When rotenone is treated with aqueous potassium hydroxide, tubaic acid, $C_{12}H_{12}O_4$, melting point 129°, is formed. Tubaic acid is converted to dihydrotubaic acid, $C_{12}H_{14}O_4$, melting point 168°, by the action of hydrogen with platinum as a catalyst. Potassium hydroxide and zinc dust convert rotenone to a mixture of derritol and rotenol. Derritol, $C_{21}H_{22}O_6$, melting point 164° (the monoxime of

BUTENANDT, A.—Continued.

which melts at 191 to 192°) splits off water to form anhydroderritol, $C_{21}H_{20}O_5$, melting point 157°, the monoacetyl compound of which melts at 146°. Rotenol, $C_{23}H_{24}O_6$, melts at 120° and is converted by hydrogen with a platinum catalyst to dihydrorotenol, $C_{23}H_{26}O_6$, melting point 131°. By the action of hydrogen with platinum as a catalyst, rotenone is converted to dihydrorotenone, $C_{23}H_{24}O_6$, melting point 216°, and dihydro-desoxy-rotenone, $C_{23}H_{26}O_5$, melting point 168°. Dihydrorotenone is converted to dihydrorotenol by sodium hyroxide and zinc dust.

——— (65)

ÜBER DIE CHEMISCHE KONSTITUTION DES ROTENONS, DES PHYSIOLOGISCH WIRKSAMEN BESTANDTEILS DER DERRIS ELLIPTICA. 49 p. Göttingën. (Inaug. Diss.) 1928.

Essentially the same material, with a fuller theoretical discussion, as that published in Ann. Chem. 464: 253–277 (*64*).

——— and **HILDEBRANDT, F.** (66)

UNTERSUCHUNGEN ÜBER PFLANZLICHE FISCH- UND INSEKTENGIFTE. II. MITTEILUNG ÜBER ROTENON, DEN PHYSIOLOGISCH WIRKSAMEN BESTANDTEIL DER DERRIS ELLIPTICA. Ann. Chem. 477: 245–268. 1930.

Rotenone, $C_{23}H_{22}O_6$, isomerizes on treatment with concentrated sulphuric acid to isorotenone, melting point 176° C. Rotenone has a strong negative rotation, and isorotenone has small positive rotation. Isorotenone does not add hydrogen or hydrochloric acid easily. With alkali, rotenone gives tubaic acid, isorotenone gives rotenic acid. Tubaic acid with concentrated sulphuric acid isomerizes to rotenic acid. This isomerism depends on the shifting of a double bond, and such a shift results in an isopropyl group, and the center of asymmetry disappears. Rotenone with iodine gives dehydrorotenone, $C_{23}H_{20}O_6$, which with alcoholic potassium hydroxide gives derrisic acid, $C_{23}H_{24}O_8$. Isorotenone with iodine gives isodehydrorotenone, $C_{23}H_{20}O_6$, melting point 191°, which with alcoholic potassium hydroxide gives isoderrisic acid, $C_{23}H_{24}O_8$, melting point 149°. Concentrated sulphuric acid changes dehydrorotenone to isodehydrorotenone and derrisic acid to isoderrisic acid. Therefore it must be that the atomic grouping concerned in the transforming of rotenone to isorotenone is present in all these derivatives as in tubaic acid.

Rotenone in acid solutions gives neutral hydrogenation products, in ammonia solutions it gives an acid, $C_{23}H_{28}O_6$. Dehydrorotenone gives a mixture of hydrogenation products.

Isorotenone and its derivatives on mild hydrogenation remain unchanged. With energetic hydrogenation Butenandt was able to hydrogenate all derivatives, but in most cases he obtained mixtures difficult to separate, which leaves this part of the work incomplete. Rotenic acid gives dihydrorotenic acid, $C_{12}H_{14}O_4$, melting point 168°. Isodehydrorotenone gives iso-dihydrodesoxyrotenone, $C_{23}H_{26}O_5$, melting point 160°. This shows that when the iso compounds are formed the double bond is shifted and placed where it becomes more difficult to hydrogenate. Dihydrorotenic acid can be separated into optical antipodes by means of well-crystallized brucine salts; the levo component shows a rotation of $[\alpha]_D^{18} = -23.17°$, melting point 165°–170°. From the results obtained Butenandt gives formulae for rotenic acid and tubaic acid at variance with those given by Takei and Koide (*392*).

Rotenone rubbed in a mortar has a melting point of 176°. When recrystallized, this material melts at 163°. Isorotenone has two crystal forms. The melting points are 176° and 184°. Rotenic acid has a melting point of 180°; when recrystallized repeatedly from ligroin the melting point falls gradually to 176°, showing that polymorphic crystal modification occurs with rotenone and some of its derivatives.

CAMPBELL, J. A. (67)

AN EXPERIMENTAL INVESTIGATION CONCERNING THE EFFECTS OF TUBA (DERRIS ELLIPTICA) FISH-POISON. Roy. Asiatic Soc. Jour. Straits Branch 73: 129–137. 1916.

Defines tuba as a term used by the Malays to denote various plants that possess fish-poisoning properties. *Derris elliptica* Benth. (*Leguminosae*) is the most powerful of these plants. Derris roots were extracted by the author with Ringer's physiological saline solution, which was then filtered and boiled. The poison passes very slowly through parchment, only one-seventieth part of the poison passing through in five days. The extract is not antiseptic, but retains its toxicity at least for a week. The root retained its full powers for three months. Tests were made with this extract upon fish (*Ophiocephalus gachua* Buch.-Ham.); tadpoles of the common Singapore toad (*Bufo melanostictus*); mosquito larvae (Stegomyia); toads (*Bufo melanostictus*); the common kra monkey (*Macacus cynomolgus*); and the pig-tailed monkey (*M. nemestpinus*). Tests were also made on the following tissues and organs removed from the body: The voluntary muscles of the tongue and of the calf of a toad; the involuntary muscle of the intestine of a monkey; heart muscle; blood of the monkey, and the blood vessels of toads and monkeys. Anaesthetized monkeys were also experimented upon.

The author draws the following conclusions from these tests: (1) Tuba fish poison (*Derris elliptica*) causes death by paralyzing the respiratory center in the medulla. The sap from 2 grams of the root when administered by mouth is sufficient to kill a monkey (*Macacus nemestpinus*). (2) It usually stimulates the respiratory center before depressing it. (3) It causes great weakness, because it weakens both voluntary and involuntary muscles and because it produces a great fall of blood pressure. (4) It has no action upon the heart muscle or heart nervous mechanism. (5) It produces a marked fall of blood pressure because it

Campbell, J. A.—Continued.

greatly weakens the muscle of the vessel walls, thus causing dilatation. (6) It causes vomiting probably by stimulating the vomiting center in the medulla; but, when large doses are swallowed, sufficient poison to cause death is absorbed even if vomiting occurs. (7) Fish poisoned by tuba can be eaten with impunity by man, because fish are killed by very small quantities of the poison. (8) It is not antiseptic, and its poisonous action is less marked on the lower members of the animal kingdom than on the more highly organized members. It kills mosquito larvae and tadpoles, but it is less toxic to these than to fish. Campbell cites the case of a suicide with tuba root in Singapore. Post-mortem examination revealed nothing but venous congestion of the organs.

Candolle, A. P. de (68)

PRODROMUS SYSTEMATIS NATURALIS REGNI VEGETABILIS, SIVE ENUMERATIO CONTRACTA ORDIUM, GENERUM, SPECIERUMQUE PLANTARUM HUC USQUE COGNITARUM, JUXTA METHODI NATURALIS NORMAS DIGESTA. Pt. 2, 644 p. Paris. 1825.

A botanical description of *Pongamia uliginosa* (*Derris uliginosa*) is given on page 416.

Carlos, A. S. (69)

DERRIS AND ITS USES AS AN INSECTICIDE. Fert. Feeding-Stuffs and Farm Supplies Jour. 11: 161. 1926.

A brief account is given of the production of derris and its use as an insecticide in England. Derris is free from any restrictions imposed under the poisons act, which hinder the sales of so many insecticides. Derris has been proved to be not only a contact poison but also a stomach poison, consequently its use in combating the various agricultural pests is of double importance. As a contact or external poison, with or without the use of soap as a spreading agent, it has been found to be effective against aphids in as low a dilution as 1 pound of root to 400 imperial gallons of water, which represents a proportion of 0.025 per cent. As a stomach or internal poison, stronger solutions are required, the lowest being 1 pound to 125 imperial gallons of water, or 0.08 per cent. Caterpillars, aphids, psylla, and red spiders are some of the chief insect pests which can be easily exterminated by the application of insecticides containing derris or its products. One interesting property of derris as a killing agent is that the effect lasts for a considerable time. Leaves when sprayed with solution containing derris preparations will remain poisonous to insects for many days.

———

SUMATRA DERRIS ROOT. Fert. Feeding-Stuffs and Farm Supplies Jour. 11: 663–664. 1926.

A general account of the cultivation and use of derris as an insecticide based on the report of United States Consul Sydney B. Redecker, Medan, Sumatra (*325*).

Castillo, N. (71)

PRELIMINARY STUDIES ON THE INSECTICIDAL PROPERTIES OF THREE SPECIES OF DERRIS IN THE PHILIPPINES. Philippine Agr. 15: 257–275. 1926.

A brief review of the literature is given. Three species of Derris were used in the investigations, namely, *D. polyantha* Perk., *D. philippinensis* Merr., and *D. elliptica* (Roxb.) Benth. The roots were cut into thin transverse slices and dried in an oven at 40° C. until the weight remained fairly constant. The dried material was then comminuted in a mortar and the powdering finally completed in a meat grinder. The fine powder was separated from the fibers by sifting through fine-meshed cloth.

In the comparative studies of the effect of various concentrations, *D. philippinensis* was used on account of its being relatively more abundant, hence more easily procurable, than the others. Insects of two types of habitat were used, namely an aquatic insect, the mosquito larva, and an aerial insect, *Aphis medicaginis* Koch (Aphididae). On mosquito larvae the most effective concentrations of *D. philippinensis* in bringing about the highest percentage of deaths in the quickest time was 3:1,000. Solutions which were either more dilute or more concentrated than 3:1,000 were found less effective. Concentrations of 1:1,000 killed 19 per cent of the larvae; lower concentrations showed no effect at all.

A concentration of 3:1,000 or higher retained its toxicity against mosquito larvae for 13 to 16 days. Concentrations higher than 3:1,000, presumably became effective later, as a result of deterioration and consequent lowering of the percentage of the toxic principles present.

The concentration of *D. philippinensis* which brought about the largest number of deaths of aphids was much higher than that required for mosquito larvae, namely, 4:1,000. The lowest concentration of *D. philippinensis* used, 0.5:1,000, caused a noticeable percentage of mortality among aphids, as compared with the control.

Against both mosquito larvae and aphids, *D. polyantha* was more effective than either of the other two. In both cases, in aqueous solutions, it showed its superiority in (1) bringing about the highest percentage of deaths (2) the short time it required to kill, and (3) the retention of its virulence. *D. polyantha* retained its virulence in water and was toxic to mosquito larvae for a period ranging from 13 to 16 days. *D. elliptica* and *D. philippinensis* were toxic for only 1 to 2 days.

CAZENEUVE, P. (72)
A PROPOS DU PROJET DE LOI SUR LA RÉPRESSION DES FRAUDES DANS LE COMMERCE DES PRODUITS INSECTICIDES ET FONGICIDES. Ann. Falsif. 21 (234): 261–266. 1928.

Discusses the proposed French law to repress frauds in insecticides and fungicides. Points out the difficulties in assaying pyrethrum, derris, and other plant insecticides. A brief review of the work of Kelsall and others (225) on derris is given.

CHRISTY, T. (73)
NEW COMMERCIAL PLANTS AND DRUGS. No. 10, 140 p., illus. London. 1887.

On page 39 it is stated that the root of *Derris elliptica* (tuba) is used as a fish poison and is well deserving of investigation. Oxley found it to be the surest remedy for destroying the insect that infests the leaves of the nutmeg and turns them yellow. The root has an extremely persistent acrid taste. The Malays use this root as one of the ingredients of their ipoh arrow poison, which is made in three forms. One, the ipoh kroki, is prepared from the root and bark of the *Antiaris toxicaria*, the root of the kopah, the root of the tuba (*Derris elliptica*) mixed with red sulphide of arsenic, and lime juice. Another is called ipoh tennik and consists of the same ingredients, but without the tuba. The third, ipoh mallaye, said to be the most powerful of these poisons, is prepared from the roots of the mallaye shrub and from perachi, kopah, and chey roots.

CLARK, E. P. (74)
THE OCCURRENCE OF ROTENONE IN THE PERUVIAN FISH POISON CUBE. Science (n. s.) 70: 478–479. 1929.

Two samples of the Peruvian fish-poisoning plant, cube, yielded 7.2 and 7.1 per cent, respectively, of crude rotenone. After recrystallization from alcohol the rotenone from cube was found to be identical in every way with rotenone from derris root.

——— (75)
SOME CONSTITUENTS OF DERRIS AND CUBE ROOTS OTHER THAN ROTENONE. Science (n. s.) 71: 396. 1930.

The extract from derris root contains, in addition to rotenone, a number of well-defined crystalline compounds. Among these the following predominate: Toxicarol, $C_{23}H_{22}O_7$, melting point 218° to 220°C., greenish yellow hexagonal plates; tephrosin, $C_{23}H_{22}O_7$, melting point 198°, white short thick prisms; another substance [deguelin], $C_{23}H_{22}O_6$, melting point 171°, pale-green rodlike plates. *Cracca* (*Tephrosia*) *toxicaria* and *vogelii*, as well as cube (*Lonchocarpus nicou*) also contain certain of these compounds. All these compounds contain two methoxyl groups and are doubtless related chemically to rotenone.

——— (76)
TOXICAROL. A CONSTITUENT OF THE SOUTH AMERICAN FISH POISON CRACCA (TEPHROSIA) TOXICARIA. Jour. Amer. Chem. Soc. 52: 2461–2464. 1930.

The ground roots of *Cracca toxicaria* were extracted with ether, the residue was dissolved in hot methyl alcohol, made alkaline with 5 per cent aqueous sodium hydroxide, and heated. A tarry substance was deposited. The supernatant liquid when diluted with three volumes of water, made acid to Congo red with sulphuric acid, and extracted with chloroform, gave about 1.3 per cent of a mixture of toxicarol, $C_{22}H_{22}O_7$, and a second compound $C_{23}H_{22}O_6$ [now known as deguelin—R. C. R.] When toxicarol is purified by solution in chloroform and addition of boiling ethyl alcohol, the chloroform being removed by boiling, bright greenish-yellow crystals, with a melting point of 219° (cor.), are obtained. The optical crystallographic data are: Plates and rods, n_α 1.580 (frequent), n_β 1.618 (common), $n_\gamma > 1.768$. The benzoate of toxicarol, melting at 202° (cor.), has the indices n_α 1.590, n_β indeterminate, n_γ 1.702. The $C_{23}H_{22}O_6$ compound is light greenish yellow, melting point 173°, n_α 1.570, n_β 1.590, $n_\gamma > 1.739$. Both compounds contain two methoxyl groups, and both are optically inactive. Toxicarol kills goldfish in a dilution of 1:20,000,000 at 27° in 4.5 hours. The second compound is lethal in 3 hours at the same dilution and temperature. Rotenone, under the same conditions, is effective in 2.25 hours.

Toxicarol has been found in derris, and the second compound in both derris and cube roots.

——— (77)
A RELATION BETWEEN ROTENONE, DEGUELIN, AND TEPHROSIN. Science (n. s.) 73: 17–18. 1931.

Derric acid constitutes one-half the molecule of rotenone, of deguelin, and of tephrosin. It is probable that tephrosin is a hydroxydeguelin.

——— (78)
DEGUELIN. I. THE PREPARATION, PURIFICATION, AND PROPERTIES OF DEGUELIN, A CONSTITUENT OF CERTAIN TROPICAL FISH-POISONING PLANTS. Jour. Amer. Chem. Soc. 53: 313–317. 1931.

Deguelin, pale green platelike rods, melting at 171°, is an active constituent of derris and cube roots, the leaves of *Cracca* (*Tephrosia*) *vogelii* and the roots of *Cracca* (*Tephrosia*) *toxicaria*. Deguelin is a dimethoxylactone, and is isomeric with rotenone, $C_{23}H_{22}O_6$. It is optically inactive.

CLARK, E. P.—Continued.

The preparation of dehydrodeguelin, dehydrodeguelone, and deguelic acid is described.

——— (79)

TEPHROSIN. I. THE COMPOSITION OF TEPHROSIN AND ITS RELATION TO DEGUELIN. Jour. Amer. Chem. Soc. 53: 729–732. 1931.

Deguelin, melting at 171° C., and a compound melting at 198° were isolated from the leaves of *Cracca vogelii*, derris root, and the roots of *Lonchocarpus nicou* (cube root). These two substances form a mixture which is difficult to separate by fractional crystallization and which appears to be the material designated by Hanriot as tephrosin. It is proposed that the name tephrosin be retained for the compound with the melting point 198°. Tephrosin is a dimethoxy lactone, $C_{23}H_{22}O_7$, which, under the influence of certain dehydrating agents, loses 1 molecule of water, forming dehydrodeguelin. It is suggested that tephrosin is a hydroxydeguelin. The action of potassium permanganate upon tephrosin results in the formation of a dicarboxylic acid, $C_{23}H_{22}O_{11}$.

CLERCQ, F. S. A. DE (80)

NIEUW PLANTKUNDIG WOORDENBOEK VOOR NEDERLANDSCH INDIË. 395 p. Amsterdam. 1909.

On page 219 are given the native names and uses as fish poisons for the following five species of Derris: *Bantamensis, elliptica, forsteniana, maingayana,* and *uliginosa.*

CORBETT, G. H. (81)

ANNUAL REPORT OF THE GOVERNMENT ENTOMOLOGIST FOR 1923. Malayan Agr. Jour. 12: 252–253. 1924.

The value of derris (tuba) as an insecticide came up during the year [1923], and plants were grown in various localities. An effort was made to collect and compare the insecticidal values of a number of plants indigenous to Malaya. Derris has a distinct usefulness as an insecticide in a restricted manner. The author maintains that it can not be compared in efficiency or price with many other new and established insecticides, and that it is dangerous to make recommendations which would encourage its growth on a large scale until more definite information is obtained, especially with regard to the toxicity of the various species. He calls attention to the fact that it is being advertised as nonpoisonous to man and animals and claims that this statement is incorrect, as it is poisonous to both man and animals to no small degree.

——— (82)

ANNUAL REPORT OF THE ENTOMOLOGICAL DIVISION FOR 1925. Malayan Agr. Jour. 14: 171–174. 1926.

The roots of tuba have been found to be very seriously damaged in storage by *Sinoxylon anale* Lesne, and this bostrichid might prove to be the limiting factor to exporting derris roots unless they are previously dealt with.

——— (83)

DIVISION OF ENTOMOLOGY—ANNUAL REPORT FOR 1927. Malayan Agr. Jour. 16: 136–140. 1928.

Investigation on the insecticidal value of derris (in collaboration with the agricultural chemist) is mentioned as one of the main researches of the division of entomology.

——— and YUSOPE, M. (84)

SCOTINOPHARA COARCTATA, F. (THE BLACK BUG OF PADI). Malayan Agr. Jour. 12: 91–106, illus. 1924.

Gives an account of experiments with kerosene emulsion and tuba root (*Derris* sp.). The results indicate that both these sprays have a marked killing effect on *S. coarctata* at various stages, but since the quantity required would make the operation of spraying too costly, unless derris plants were grown by the cultivators, this method of combating the insect is not recommended.

CROUCHER, H. H. (85)

ACTION OF INSECTICIDES. Sugar 30: 266–267. 1928.

Reviews the work of Tattersfield (*403*) and others. Mentions *Derris elliptica* as a fish poison and an insecticide.

DALZELL, N. A., and GIBSON, A. (86)

THE BOMBAY FLORA: OR, SHORT DESCRIPTIONS OF ALL THE INDIGENOUS PLANTS HITHERTO DISCOVERED IN OR NEAR THE BOMBAY PRESIDENCY; TOGETHER WITH A SUPPLEMENT OF INTRODUCED AND NATURALIZED SPECIES. 319 p. Bombay. 1861.

Gives a botanical description of *Derris uliginosa* from the region of Bombay (p. 77).

DANIEL, D. M. (87)

BIOLOGY AND CONTROL OF THE BLACKBERRY LEAF-MINER. N. Y. State Agri. Expt. Sta. Tech. Bul. 133, 37 p. 1928.

The blackberry leaf-miner (*Metellus rubi* Forbes) is probably a limiting factor in the culture of blackberries in western New York. Derrisol, in a dilution of 1 to 200, averaged 69 per cent control when sprayed upon the larvae.

DANIELS, C. W. (88)

A PLEA FOR THE SCIENTIFIC STUDY OF NATIVE DRUGS AND POISONS. Jour. Malaya Branch Brit. Med. Assoc. (Singapore) (n. s.) no. 2; 3–5. 1905. [Reviewed in Brit. Med. Jour. no. 2373; 1475. 1906.]

States that the Chinese cultivate tuba root, *Derris elliptica,* which is a common article for sale in the markets of the towns. Refers to Ridley, Wright, and Travers. Mentions that Wright for some time used it most successfully in the destruction of bedbugs in jails in Perak. According to Travers, it is useful in destroying the ticks on dogs. Some have used it successfully for lepidopterous larvae; others, in the main unsuccessfully, in dealing with termites. It rapidly destroys protozoa both amoebae and flagellata. Rotifers, nematode larvae, and the smaller nematodes are also completely destroyed. It destroys insect larvae less rapidly, but in most instances within a few hours. Pupae are not affected to the same extent, and some coleopterous larvae and the larvae of dragon flies are only temporarily injured. A fragment of crushed fresh root can be used effectively under all circumstances where kerosene can be used to destroy mosquito larvae. The effects on larvae in semisolid masses, such as dipterous larvae in cesspits filled with semisolid material, are local only. The active agent of tuba root is readily soluble in alcohol, but the alcoholic extract, well diluted, is less effective than the fresh root macerated in the same volume of water. Derris has no permanent effect on bacteria and fungi.

DARLEY, M. M. (89)

SOME COMPARATIVE TESTS WITH ROTENONE, NICOTINE AND PYRETHRUM. Jour. Econ. Ent. 24: 111–115. 1931.

Rotenone was used in two stock solutions, one consisting of 0.2 gram rotenone, 5 cubic centimeters benzol, and 95 cubic centimeters Penetrol; the other of 1 gram rotenone in 50 cubic centimeters acetone.

A few preliminary tests with the cone-flower aphid, *Macrosiphum rudbeckiae,* on goldenrod gave the following results: Black Leaf 40 at 1:1,000 (nicotine 1:2,500) produced a mortality of 56 per cent; Nicotrol at 1:200 (nicotine 1:10,000), 97.9 per cent; Penethrum at 1:200 (pyrethrins 1:74,800), 80 per cent; No. 519 at 1:200 (rotenone 1:100,000), 96.9 per cent. The check mortality was 23.2 per cent.

In tests against the false cabbage aphid, *Rhopalosiphum pseudobrassicae,* in the field, and the spiraea aphid, *Aphis spiraecola,* in the laboratory, rotenone at a concentration of 1:100,000, as a contact poison in spray form, was found to compare favorably in toxicity with nicotine at 1:10,000 and pyrethrins at 1:74,800. Penetrol at the same concentration (1:200) was used in each spray.

Against adults of the spotted cucumber beetle, *Diabrotica duodecimpunctata,* and the Mexican bean beetle, *Epilachna corrupta,* pyrethrins at 1:37,400 were effective, whereas nicotine at 1:5,000 was ineffective. Penetrol at 1:100 was used in each spray. A rotenone concentration of 1:1,000 (plus Penetrol 1:200) was necessary before a mortality above 90 per cent was secured with adults of *D. duodecimpunctata.*

Some preliminary tests with the common red spider, *Tetranychus telarius,* indicate that the relative toxicity of rotenone to this pest, as compared with the toxicity of nicotine and pyrethrins, is appreciably greater than its relative toxicity as indicated in the aphid tests.

DAVIDSON, W. M. (90)

RESULTS OF EXPERIMENTS WITH MISCELLANEOUS SUBSTANCES AGAINST THE CHICKEN MITE. U. S. Dept. Agr. Bul. 1228, 10 p. 1924.

Four infested chicken houses inhabited by the common red mite of the chicken (*Dermanyssus gallinae* Redi) were dusted with the finely ground powder of the roots of derris. Undiluted dust was efficient in one house and temporarily so in another. In a third house a 75 per cent dust was only moderately efficient; in a fourth test a 50 per cent dust was inefficient. Flour was used as a diluent.

Derris powder is a remedy of value, but it would appear that two or more applications are necessary and that it loses its efficiency if diluted more than 25 per cent. It acts on larvae and adult mites by stupefying them, the insects dropping to the ground and dying after two or three days. The material is rather unpleasant to apply.

Extract of derris, 16 per cent, diluted to 1 to 1,000 and 1 to 500, with the addition of whale-oil soap, 4 pounds per 100 United States gallons, was inefficient.

——— (91)

ROTENONE AS A CONTACT INSECTICIDE. Jour. Econ. Ent. 23: 868–874. 1930.

Pure rotenone, recrystallized from alcohol, was tested in the form of (1) suspensions produced by adding an acetone solution of rotenone to water, and (2) diatomaceous earth powders containing 1 or 2 per cent very finely divided rotenone. The following insects were used in these tests: *Adelges,* ova, on pine; *Anasa tristis* De Geer, hibernating adults and nymphs, on squash; *Anuraphis roseus* Baker on apple; *Aphis gossypii* Glove on celery; *A. persicae-niger* Smith on peach; *A. pomi* De Geer on apple; *A. rumicis* L. on nasturtium; *Blattella germania* L. in a wire

DAVIDSON, W. M.—Continued.

cage; *Brevicorne brassicae* Koch on cabbage; Culicine mosquito larvae in tubs; *Diabrotica 12-punctata* Oliv., adults, on potato; *Doryphora 10-lineata* Say., ova, small and large larvae, and adults, on potato; *Epilachna corrupta* Muls., small and half-grown larvae and adults, on bean; *Illinoia liriodendri* Monell, active, on tulip tree; *Malacosoma americana* Harris, first, second, and third stage larvae, on plum and apple; *Menopon pallidum* Nitzch on chickens; *M. stramineum* Nitzch on chickens; *Myzus persicae* Sulz on cabbage; *Pontia rapae* L., large larvae, on cabbage; *Popilia japonica* Newman, adults, on smartwood foliage; *Pseudococcus citri* Risso on coleus; *Tetranychus telarius* L. on bean; *Thrips tabaci* Lind., adults and larvae, on bean; *Thrips* sp., larvae, on *Plantago lanceolata; Trialeyrodes vaporariovum* Westwood ova, larvae, and pupae, on bean; *Typhlocyba comes* Say., nymphs, on grape.

Tests were made in a greenhouse and also in the field. In suspensions rotenone proved valuable against such soft-bodied insects as aphids, thrips, leaf hoppers, caterpillars, beetle larvae, and the immature stages of culicine mosquitoes. When freshly dispersed in water by dilution of an acetone solution, rotenone is effective against *Aphis rumicis* at a concentration about one-fifteenth of that at which nicotine is effective. Aqueous suspensions were not effective against red spiders, mealybugs, and squash bugs. This inefficiency against squash bugs, red spiders, and possibly mealybugs appears to be due more to lack of penetrating power in the suspensions used than to absence of intrinsic toxicity, and would probably be remedied by incorporating rotenone in a penetrating carrier. such as an oil. Roaches, potato beetles, and cucumber beetles resisted the suspension sprays.

Dusts containing 1 and 2 per cent rotenone were only moderately effective against soft-bodied sucking insects. They controlled cabbage worms, young Mexican bean-beetle larvae, roaches, and both body and shaft lice on chickens; the roaches were controlled, perhaps, more through internal poison than contact action.

——— (92)

THE RELATIVE VALUE AS CONTACT INSECTICIDES OF SOME CONSTITUENTS OF DERRIS. Jour. Econ. Ent. 23: 877–879. 1930.

Aqueous suspensions of the four principal constituents of derris root—that is, rotenone, deguelin, tephrosin, and toxicarol—were sprayed upon aphids, thrips, white-fly larvae, and red-spider mites living on potted plants in a greenhouse. Their relative contact insecticidal value was in the order given, rotenone being the most potent; in toxicity to *Aphis rumicis*, they stood in the approximate ratio of 400:40:10:1. Rotenone and deguelin are both more toxic than nicotine to *A. rumicis*.

——— and JONES, H. A. (93)

CHANGE IN TOXICITY OF ROTENONE IN SOLUTION AND SUSPENSION. Jour. Econ. Ent. 24: 258–262. 1931.

Rotenone in solution in pyridine, or in acetone to which tannic acid has been added, rapidly loses its insecticidal effectiveness. This loss in toxicity is accompanied by a decrease in optical activity and a progressive yellowing of the solution. Atmospheric oxidation of the rotenone appears to account for these changes. Suspensions of rotenone formed by adding various solutions of it to water were sprayed upon aphids (*Myzus persicae* Sulz.), *Brevicoryne brassicae* K. and *Pontia rapae* L. larvae, on potted cabbage plants in a greenhouse, and on grape leaf hoppers (*Typhlocyba comes*) on grapes in the field.

The yellow crystalline material resulting from the oxidation of rotenone in pyridine solution was tested upon goldfish and upon insects and found to be very much less toxic than rotenone.

In acetone or in alcohol, rotenone decomposes only very slowly. In aqueous suspensions made from fresh acetone and alcohol stock solutions, rotenone suffers a loss in toxicity on standing. H. H. Shepard, using *Aphis rumicis* as the test insect, has also noted this.

DELGADO, F. A. (94)

TUBA ROOT (DERRIS) OFFERED AMERICAN IMPORTERS BY SINGAPORE FIRM. U. S. Dept. Com., Bur. Foreign and Dom. Com., World Trade Notes on Chemical and Allied Products 3(48): 13. 1929. [Also in Oil, Paint and Drug Reporter, December 2, 1929, p. 60.]

States that a Singapore dealer is in a position to supply 1 or 2 tons of derris root monthly to any American firm interested. This root, grown on the island of Singapore, is considered to be the best quality, the toxic properties being rated at the maximum strength when the root is fresh. Although it is dried, it is said to maintain its strength to a greater percentage than any other variety in the fresh state. Gives the present price of the dried root as about $50 gold (Malayan currency) per picul (133⅓ pounds). (This is equivalent to 21 cents per pound in United States money.)

DE LONG, D. M. (95)

SOME OBSERVATIONS UPON THE BIOLOGY AND CONTROL OF THE POTATO LEAF-HOPPER (EMPOASCA FABAE HARRIS). Jour. Econ. Ent. 21: 183–188, illus. 1928.

A large variety of insecticides have been given comparative tests in plot work during the past two seasons. A number of these were of little or no value as controls. Such materials as a commercial white oil emulsion (2 per cent), a cocoanut fatty acid emulsion, a commercial derris product (1–250), and the fluosilicates in either wet or dry form proved unsatisfactory. Even nicotine at a dilution of 1 to 800, in combination with soap or oil, did not give sufficient control to warrant its recommendation.

DENNIS, W. J. (96)

VERMIFUGE AND INSECTICIDE. U. S. Patent 1621240, issued March 15, 1927; applied for April 16, 1923.

An alcoholic extract of cube is stated to have slightly greater effectiveness when sprayed on the cotton aphid than nicotine sulphate, and it is also claimed to be eight times as effective as similar derris extract.

DE ONG, E. R. (97)

THE COMPARATIVE INSECTICIDAL VALUE OF DIFFERENT SPECIES OF DERRIS. Jour. Econ. Ent. 23: 619–624. 1930.

Authentic specimens of four species of Derris were obtained from the Bureau of Forestry of the Philippine Islands. These were: *Derris elliptica* (Roxb.) Benth.; *D. heptaphylla* (Linn.) Merr. (synonym, *D. sinuata* Thw.); *D. polyantha* Perk.; *D. trifoliata* Lour. (synonym, *D. uliginosa* Roxb.).

The ether extract of the roots and trunks of these ranged from 1.87 to 4.18 per cent. Insecticidal tests were made with the ether extract dissolved in pyridine or alcohol to which a little sodium oleate was added and with the finely powdered plant material, upon beetles (*Hippodamia convergens* Guerin), rose aphids (*Myzus rosarum* Walker, woolly apple aphis (*Eriosoma lanigera* Hausm.), and butterfly larvae (*Euphydryas chalcedona* Dbldy. and Hen.)

All species of Derris tested showed sufficient insecticidal value to warrant commercial experimentation both with ether extracts and the ground powder. *Derris elliptica* showed a certain degree of superiority over the other species tested but not such as to warrant classifying the latter as inefficient. Valuable inherent insecticidal properties were found in all species tested as toxic agents in immersion tests, as aphicides, and as a repellent for a species of defoliating caterpillar. These toxic values were found to be present in all parts of the plants tested, although in slightly varying amounts.

——— and WHITE, L. T. W. (98)

FURTHER STUDIES OF DERRIS AS AN INSECTICIDE. Jour. Econ. Ent. 17: 499–501. 1924.

There are 40 or more species of the genus Derris, 12 of which are found in the Philippine Islands. According to H. E. Woodworth, formerly of the College of Agriculture, University of the Philippines, Los Banos, the leaves, flowers, and young shoots of derris are inert, but the roots, and usually the stem, are quite active insecticidally. Woodworth's tests were made with *D. philippinensis*, *D. elliptica*, and undetermined species of Derris. De Ong and White prepared extracts from dried roots of derris (probably *D. elliptica*), using as solvents petroleum ether, ether, alcohol, and water. Pyridine was found to the most satisfactory solvent for all the extracts, except the alcoholic, which was soluble in both ethyl and methyl alcohol. Pyridine solutions of the ether extract and petroleum ether extract of derris were subcutaneously injected into guinea pigs. The tests indicate a very slight susceptibility to the action of derris on the part of the guinea pig.

"The commercial extract of 16 per cent concentration diluted 1 to 500 gave a 13 per cent control on *Aphis nerii* Fons., and a 50 per cent control on the green peach aphid (*Rhopalosiphum persicae* Sulzer). Dilutions of 1 to 300 gave a maximum control of 68 per cent on the latter species of aphid and 25 per cent on the red spider (*Tetranychus telarius* Linn.). Dilutions of the same concentrate at 1 to 500 added to mosquito-infested water killed 65 per cent of the larvae but had no effect on the pupae. The powdered Derris root (undiluted) sprinkled on the surface of the water killed 90 per cent of the larvae in two to four hours. The same powder when dusted on aphids was 100 per cent effective in eight hours and gave a 98 per cent control of the larvae of *Euphydryas chalcedona* when dusted on the leaves upon which they were feeding. From these experiments it is judged that the active principle, 'Derris' is both a stomach and a 'respiratory' or tracheal poison. The reaction on the caterpillars must have resulted from ingestion of the powder, since fumigating tests with the material gave negative results, while the fumigating action of the commercial Derris extract was close to that of the toxicity curve for spraying. A check test on pyridine as a fumigant gave an efficiency of three and eight-tenths per cent."

"Powdered Derris root diluted to a 20 per gent concentration with calcium carbonate, as well as the commercial Derris dusts, gave perfect control on chicken lice (*Menopon biseriatum* Prag. and *Gonicotes gigas* Tasch.) and Giropid lice (*Gyropus ovalis* Nitzsch and *Gliricola porcelli* Linn.) on the guinea pig. The control of lice on large numbers of guinea pigs is often a perplexing problem, especially in research work where perfect normality is desired for all experimental animals. Lice are especially difficult to control on young pigs and brood sows, the former often showing a high mortality. Powdered Derris at 20 per cent dilution has given good satisfaction to the veterinarians at the University of California for this type of work, the powdered Derris being applied to birds by the pinch method of dusting on the infested areas. On pigs, the powder was rubbed into the fur over the entire body or in treating pregnant sows the dust was applied behind the ears and on the back."

DON, G. (99)

GENERAL HISTORY OF THE DICHLAMYDEOUS PLANTS, COMPRISING COMPLETE DESCRIPTIONS OF THE DIFFERENT ORDERS. V. 2, CALYCIFLORAE. 875 p., illus. London. 1832.

A botanical description of *Pongamia elliptica* (*Derris elliptica*) is given (p. 476).

DRAGENDORFF, G. (100)

DIE HEILPFLANZEN DER VERSCHIEDENEN VÖLKER UND ZEITEN. Ihre Anwendung, wesentlichen Bestandtheile und Geschichte. 884 p. Stuttgart. 1898.

Lists *Derris uliginosa* as a fish poison and a medicine and *Derris elliptica* as a fish poison (p. 328).

DURHAM, H. E. (101)

Private communication to John D. Gimlette (*141*); also abstracted by Tattersfield and Roach (*405*).

DUYSTER, M. (102)

GIFTIGE INDISCHE PLANTEN EN PLANTENBESTANDDEELEN. 143 p., Bandoeng. 1927.

Derris uliginosa and *D. elliptica* are described as fish poisons. An account is given of the chemical nature and pharmacological action of the constituents of the latter species, based on the work of Greshoff, Van Sillevoldt, Van Hasselt, and others (p. 57–61).

DYMOCK, W., WARDEN, C. J. H., and HOOPER, D. (103)

PHARMACOGRAPHIA INDICA—A HISTORY OF THE PRINCIPAL DRUGS OF VEGETABLE ORIGIN MET WITH IN BRITISH INDIA. v. 1, 599 p. London, Bombay [etc.] 1890.

A botanical description of *Derris uliginosa* is given on pages 470–472. Its habitat is eastern Himalayas, the western peninsula of India, and Ceylon. In India it is known to act as a poison upon worms and the larvae of insects which trouble the cultivator, whence the Marathi name "Kirtána," or "worm-creeper."

A proximate analysis of the bark reveals the presence of a neutral crystalline principle; a wax and two resins in the ether extract; two coloring matters; an alkaloid and glucose in the alcoholic extract; an acrid glucoside allied to saponin, together with gum, in the aqueous extract; and 8 per cent of mineral matter. The bitterish alkaloid gives a fine red color with sulphuric acid and a violet color with oxidizing agents. It is associated with the coloring matter, soluble in water, which is of an acid nature and strikes a deep reddish brown with ferric chloride, and a reddish pink with ferrous sulphate. The glucoside is precipitated with barium hydrate with coloring matter, and the latter is left in an insoluble condition by dissolving the barium compound in hydrochloric acid. On boiling this solution the decomposition is readily effected, with the formation of glucose and an insoluble body differing from sapogenin in its appearance and solubility in spirit. The resin more soluble in rectified spirit is dark reddish-brown and freely soluble in alkali; the less soluble resin is light brown, brittle, and soluble only in a large quantity of alkali. They are both acid in reaction.

ENGLER, A., and PRANTL, K. (104)

DIE NATÜRLICHEN PFLANZENFAMILIEN NEBST IHREN GATTUNGEN UND WICHTIGEREN ARTEN, INSBESONDERE DEN NUTZPFLANZEN, UNTER MITWIRKUNG ZAHLREICHER HERVORRAGENDER FACHGELEHRTEN. v. 3, 396 p., illus. Leipzig. 1894.

Gives a botanical description of the genus Deguelia (*Derris* Lour.) (p. 345).

EYER, J. R. (105)

TESTS OF SOME RECENTLY DEVELOPED INSECTICIDES IN CONTROL OF THE GRAPE LEAF HOPPER AND ORIENTAL FRUIT MOTH. Jour. Econ. Ent. 20: 253–261. 1927.

Derrisol at the rate of 1 pint per 100 gallons killed 100 per cent of the nymphs of the grape leaf hopper (*Typhlocyba comes* Say). Combined with Bordeaux mixture 8–8–100, it killed 98 per cent of the nymphs. Foliage caged five days after spraying with Derrisol, 1 pint to 100 gallons, indicated approximate control of 98 per cent, and the same combined with an 8–8–100 Bordeaux mixture gave a control of 96 per cent. As an ovicide Derrisol was not so effective as pyrethrum soap emulsion.

FERNALD, H. T. (106)

BIOLOGY AND CONTROL OF THE CARROT RUST FLY. Mass. Agr. Expt. Sta. Bul. 247: 319. 1929. (Bien. Rpt., 1927 and 1928.)

States that W. D. Whitcomb has found that asphalt mulch paper, derris compounds, corrosive sublimate, and sodium fluosilicate give very encouraging results against the first generation of carrot rust fly but are ineffective against the second generation.

FIELD, W., and others. (107)

REPORT OF THE DEPARTMENTAL COMMITTEE ON WARBLE FLY PEST. [Gt. Brit.] Min. Agr. and Fisheries, 4–48. 1926.

Describes tests against ox warbles made with a proprietary powder, Kurmange, which consists of the ground roots of *Derris elliptica* and other species of Derris, and is manufactured by McDougall & Robertson (Ltd.), of Manchester, England.

FIELD, W., and others—Continued.

Kurmange, used in the strength of 1 ounce to a quart of water, killed 86 per cent of the larvae. One ounce of Kurmange to 1 pint of water killed 95 per cent of the larvae. Cattle dressed with Kurmange suffered no injurious effects.

The committee have had considerable facilities for testing the insecticide known as derris or tuba root. Doctor MacDougall's reports on its use in experiments during 1924 indicate that a dressing containing the active principles of derris root is likely to prove very valuable in the destruction of warble larvae. Information received from various sources (*425, 433*) confirms this opinion. Derris has an advantage over the tobacco dressing in that, being a powder, it is easily carried and is ready to be mixed and applied immediately. The weakness of the tobacco treatment lies in the trouble and inconvenience of preparation and handling, the necessity for steeping the mixture in water for 24 hours, and the difficulties of transporting the prepared solution in bulk. The derris, and to a certain extent also the nicotine sulphate dressings, do not present the same difficulties and on that account should make a stronger appeal to the stock owner. Unfortunately, there is not at the moment any nonproprietary standardized form of derris root on the market, and farmers would find it difficult, if not impossible, to purchase small quantities of ground derris root with known insecticidal properties. Under these circumstances the committee feel that the exploitation of insecticides derived from derris root for the purpose of destroying warbles must be left to the firms interested in the production of insecticides.

FILET, G. J. (108)

PLANTKUNDIG WOORDENBOEK VOOR NEDERLANDSCH-INDIË; MET KORTE AANWIJZINGEN VAN HET GENEESKUNDIG- EN HUISHOUDELIJK GEBRUIK DER PLANTEN, EN VERMELDING DER VERSCHILLENDE INLANDSCHE EN WETENSCHAPPELIJKE BENAMINGEN. 362 p. Leiden. 1876.

Gives native names and uses as fish poisons of *Derris uliginosa* (No. 507, p. 28); *D. pubipetala* (No. 2068, p. 100); *D. multiflora* (No. 2212, p. 106); *D. forsteniana* (No. 2955, p. 134); and *D. montana* (No. 7822, p. 287). They are found in the Dutch East Indies.

FISHER, H. J., and BAILEY, E. M. (109)

THE COMPOSITION OF SOME COMMERCIAL INSECTICIDES, FUNGICIDES, BACTERICIDES, RODENTICIDES, AND WEED KILLERS. Conn. Agr. Expt. Sta. Bul. 300, p. 207–368. 1929.

The analysis of derris root given in the Canada Department of Agriculture, Division of Chemistry, Report for 1928, is reproduced (*365*). Derrisol, manufactured by William Cooper & Nephews (Inc.), Chicago, Ill., was examined and gave the following results (p. 248):

Guaranteed: Derris extract, 5 per cent; fatty acid, 50 per cent; inert matter, 45 per cent.

Found: Nonvolatile chloroform extract, 60.45 per cent; water, 18 per cent; ash, 8.08 per cent; combined fatty acids (calculated from alkalinity of soluble ash), 0.62 per cent. The fatty acids if present must be in the free form and not as soap.

FLINT, W. P. (110)

ORCHARD INSECT CONTROL FOR 1928. Ill. Hort. Soc. Trans. (1928) 62: 97–109. 1929.

In southern Illinois two commercial sprays using a 2 per cent white oil emulsion allowed an infestation of codling moth of 1.1 per cent and 0.7 per cent, respectively. The same oil at 1 per cent plus nicotine sulphate 1–800 allowed 0.3 per cent codling moth infestation, and a similar experiment with Derrisol (commercial derris extract) at the same dilution gave 1.1 per cent. The plot sprayed with a commercial spray, in the same orchard in which arsenate of lead was used in the second brood sprays gave 5.2 per cent infestation of codling moth. The check showed that 31 per cent of the apples were injured by this insect.

Nearly as good results were obtained in a second orchard in western Illinois. but in this orchard the control of curculio was very poor.

FLIPPANCE, F. (111)

A GUIDE TO THE PALM COLLECTION IN THE BOTANIC GARDENS. II. Gard. Bul Straits Settlements 2: 246–258. 1920.

Tuba-root powder is suggested for the control of various small beetles attacking palms in the Straits Settlements, also for use against the larvae of the large coconut butterfly (*Amathusia phidippus*) and the larvae of *Erionota thrax.*

FOOTE, W. A. (112)

TUBA ROOT PRODUCTION IN SUMATRA. U. S. Dept. Com., Bur. Foreign and Dom. Com. Spec. Circ. 192. 1928.

Considerable quantities of derris root are being shipped to Europe, Australia, and America. In Sumatra derris is not being produced as a regular plantation item, but is cultivated only when new jungle land has been cleared and first planted with rubber trees. The European estate owners in Sumatra state that there is no profit in the production of tuba root and that it is cultivated during the first 18 months immediately after the clearing of the jungle merely to assist in covering expenses. The total production of tuba root during 1928 was probably 300 tons.

Foote, W. A.—Continued.

The following formula is used to determine the strength of derris extract: A small quantity of the extract is added to 1 liter of water containing a live fish, then

$$\frac{\text{Number of minutes required to kill fish}}{\text{Weight of the fish in grams}}=\text{Strength}$$

If the extract is of the proper strength, the result is 4. The author states that the local consumption of derris in Sumatra totals 16 tons per annum. The tobacco planters would much prefer to use nicotine instead of derris, but the present price of nicotine is prohibitive, amounting approximately to double the cost of derris. It is stated that nicotine stuns fish more quickly than derris extract. The local price of Sumatra derris root ranges between 0.9 and 1.1 florins per kilo. This is equivalent to 16 to 20 cents per pound.

According to chemists who specialize in extracting the derris from the roots, time does not decrease the quantity of active substance in the root. It is true, however, that after the passage of a considerable length of time, the roots harden, thereby making it more difficult and expensive to extract the derris. When the derris is extracted at once, the process is comparatively simple, as the roots are soft and pulpy.

——— (113)

AREA PLANTED WITH DERRIS IN THE MALAY PENINSULA DOUBLED FROM 1925 TO 1927. U. S. Dept. Com., Bur. Foreign and Dom. Com., World Trade Notes on Chemicals and Allied Products 3 (27): 10. 1929.

Quotes from the Malayan Agricultural Journal to show that in the Malay Peninsula 1,077 acres were planted in derris in 1925, and 2,147 acres in 1927, principally in Johore. The derris culture is chiefly in the hands of the Chinese, though the Japanese are also interested to a smaller extent.

——— (114)

THE UNITED STATES IS SUMATRA'S BEST CUSTOMER. U. S. Dept. Com. Rpt. 13, p. 9. 1929.

Derris root was sent to the United States for the first time in 1928. The shipment amounted to 2,000 pounds.

——— (115)

THE USE OF TUBA ROOT (DERRIS ELLIPTICA) EXTRACT IN FIGHTING TOBACCO PLANT PESTS. Medan, Sumatra, Rpt. 15, p. 42. 1929.

A complete account of the production of derris extract and its use in combating tobacco insects. This information was obtained from Kuijper (*234*).

——— (116)

APPLICATION OF INSECTICIDES IN SUMATRAN TOBACCO FIELDS. U. S. Dept. Com., Bur. Foreign and Dom. Com., World Trade Notes on Chemicals and Allied Products 5 (8): 4–5. 1931.

A liquid contact insecticide prepared from derris is used for the control of the tobacco louse. It is sprayed on each leaf by hand pumps.

Friedrichs, K. (117)

PROEVEN TER BESTRIJDING VAN DEN KOFFIEBESSENBOEBOEK MET TWEE CHEMISCHE MIDDELEN. Meded. Koffiebessenboeboek Fonds [Java] no. 9, p. 215–218. 1924.

Tests with Phytophyline, a proprietary preparation of the root of *Derris elliptica*, and soap are described. This preparation proved ineffective and too costly for use against the coffee-berry borer (*Stephanoderes hampei*).

Fryer, J. C. F., Stenton, R., Tattersfield, F., and Roach, W. A. (118)

A QUANTITATIVE STUDY OF THE INSECTICIDAL PROPERTIES OF DERRIS ELLIPTICA (TUBA ROOT). Ann. Appl. Biol. 10: 18–34, illus. 1923.

Gives an account of an investigation in which extracts of *Derris elliptica* are shown to have a high insecticidal value, particularly for caterpillars. They are not so toxic to aphids.

The principles of the root toxic to insects are the white crystalline derivative, usually called tubatoxin, and a resin of a golden yellow color identical with the derrid of Sillevoldt (*366*). Both these compounds when finely dispersed in water have considerable toxic properties to insects.

The dry root itself may be used in a finely powdered condition worked up with water together with soap or other emulsifying reagents. As the pure poisons found in derris root are solids and only slightly soluble in water, their toxicity appears to depend upon their degree of dispersion.

A biological method of determining insecticidal properties quantitatively is described. It depends on dipping insects for a constant period of time in known strengths of highly dispersed suspensoids in dilute aqueous solutions of saponin. Results agreeing with those given by the chemical method already described were obtained. It enabled the authors to compare extracts of derris with nicotine. To cer-

FRYER, J. C. F., STENTON, R., TATTERSFIELD, F., and ROACH, W. A.—Continued.

tain caterpillars tubatoxin and derrid are shown to be of the same order of toxicity as nicotine. These conclusions are based on tests with the following insects: Caterpillars of the cabbage white butterfly (*Pieris brassicae*), the lackey moth (*Malacosma neustria*), the buff-tip (*Phalera bucephala*), the gooseberry sawfly (*Pteronus ribesii*), those of another sawfly (*Phymalocera aterrima*). Tests were also made with larvae of the tomato moth (*Hadena oleracea*) and with silkworms (*Bombyx mori*).

FRYER, P. J. (119)

DERRIS AS AN APHIS SPRAY. Fla. Grower 33(14): 20. 1926.

Derrisol should be diluted with water 1 to 10 and this solution then added to water to make a final dilution of 1 pint Derrisol per 100 United States gallons. Soap may be used with Derrisol, but its use is unnecessary. Derrisol can be used as a mixed spray with oil emulsion, lime sulphur, Bordeaux, and arsenates, care being taken that the Derrisol is added only to the diluted insecticides, as the concentrated spraying material may throw out some of the active ingredient. Derrisol is stated to be effective against the citrus aphid, and aphids and other insect pests on hops and fruits in England.

——— (120)

INSECTICIDE, SHEEP DIP, AND THE LIKE. U. S. Patent 1583681, issued May 4, 1926; applied for November 29, 1924.

The patentee claims an insecticide comprising derris, a vehicle of a sulphonated fatty body, and a colloidal addition agent. The preferred insecticide consists of 1 part of derris extract to 10–50 parts of sulphonated oil or wax, for example, sulphonated castor oil. If it is desired to use this material in combination with lime-sulphur so as to produce a combined insecticide and fungicide, precipitation of the material may be prevented by the addition of a colloidal agent, of which casein (5 to 20 per cent) is found most suitable.

The active principles of derris are extracted with benzene or other suitable volatile solvent. An extract of perkakal may be similarly used.

FULMEK, L. (121)

IETS OVER DE TOEPASSING VAN BESTRIJDINGSMIDDELEN BIJ DELITABAK. Vlugschr. Deli Proefsta. Medan 29: 1–4. 1924.

Akar tuba is listed as a contact insecticide. The addition of 0.3–0.5 per cent soap to solutions of derris is advised for use against tobacco pests in Sumatra.

——— (122)

BESTRIJDING VAN BLADLUIZEN. Vlugschr. Deli Proefsta. Medan 30: 1–4 1924.

For leaf lice, the author recommends Akar tuba (derris) at the rate of 1 kilogram in 100 liters water to which 0.5 kilogram soap is added.

——— (123)

TECHNIEK DER BLADLUIZENBESTRIJDING MET AKAR TOEBA. Vlugschr. Deli Proefsta. Medan 33: 1–4, illus. 1925.

Directions are given for spraying against leaf lice with derris. The formula is 1 kilogram akar tuba (derris), 100 liters water, and 300 grams soap.

FULMER, H. L. (124)

INSECTICIDES, FUNGICIDES, AND HERBICIDES. Ontario Dept. Agr. Bul. 351, 75 p. 1930.

Green apple aphis and the nasturtium aphis can be controlled by spraying with ground derris root at the rate of 1 pound to 20 imperial gallons of water, and mosquito larvae are destroyed by a concentration of 1 pound to each 1,000 imperial gallons of water. Fleas, lice, house flies, and warble fly larvae are also amenable to the poison in derris root. Pulvex and Derrisine contain extracts of derris as their active ingredient (pp. 44–45).

FURNESS, W. H. (125)

THE HOME LIFE OF BORNEO HEAD-HUNTERS—ITS FESTIVALS AND FOLKLORE. 197 p., illus. Philadelphia. 1902.

States that two varieties of tuba are known to the natives and used by them to poison fish in streams. They are called tuba berâbut, a shrub, and tuba ja jaran, a creeper. Tuba berâbut is more generally used and is known botanically as *Derris elliptica*. The poison is extracted from the bark of the creeper and from the tubers and roots of the shrub. It seems to kill the fish by suffocation and does not injure them for food. As they do not die at once, but rise to the surface of the water and dart hither and thither to evade the poison, there is not a little sport in spearing them or scooping them up in nets. Tuba fishing is made a great occasion by all the tribes and furnishes almost as fruitful a topic of conversation as a war expedition. The tuba root is scorched over a fire to make it more virulent. The tuba roots are pounded to a pulp and then swashed round and squeezed out in some of the smaller canoes which have been half filled with water. Clay or lime is mixed with

FURNESS, W. H.—Continued.

the poison to make it sink and spread through the water. The poison causes the fish to come to the surface of the water. They are then speared or scooped into a net (p. 185–189).

GARMAN, P. (126)

TESTS WITH INSECTICIDES DESIGNED TO DO THE WORK OF NICOTINE SULPHATE. Conn. Agr. Expt. Sta. Bul. 294, p. 277–278. 1928. (State Ent. Rpt. 27, 1927.)

One of the commercial preparations of derris was tried in 1927 against the mealy plum aphis and showed good killing power, although it failed to accomplish a thorough clean-up on account of poor spread. It is quite evident that soap or casein lime is needed in combination. The product investigated does not mix well with winter-strength lime-sulphur solution.

Both derris and pyrethrum have considerable value as aphicides, but their success for orchard use will depend on their ability to combine with other insecticides and fungicides. The present cost does not seem to be any lower per 100 gallons of spray mixture than nicotine sulphate, and no reliable information is available regarding their keeping qualities. The only advantage that can be seen from using the abovementioned aphicides in an orchard will lie in increased safety of the operator.

Tests with derris and pyrethrum against the mealy plum aphis:

Substance (commercial preparations)	Dilution	Per cent of kill
A. Derris preparation	1 ounce to 6 gallons	88.3
B. Derris preparation	2 ounces to 6 gallons	97.6
C. Pyrethrum soap	2 pounds to 3¾ gallons	94.4
D. Nicotine sulphate	1 ounce to 6 gallons	92.2
E. Check, no treatment		0

——— (127)

THE ORIENTAL PEACH MOTH IN CONNECTICUT. Conn. New Haven Agr. Expt. Sta. Bul. 313, p. 401–451, illus. 1930.

Peach shoots sprayed with rotenone 0.075 or 0.1 gram in 100 cubic centimeters water to which 1 or 2 grams sirup or honey had been added were placed in cages containing adult moths. On the treated peach shoots 854 eggs were deposited, as compared with 2,217 on untreated shoots (p. 428).

White-oil emulsion 1.3 grams, derris preparation 1 gram, and water to 600 cubic centimeters killed 60 per cent of the eggs; white-oil emulsion 1.6 grams, derris preparation 1 gram, and water to 600 cubic centimeters killed 68 per cent of the eggs; and white-oil emulsion 1.3 grams, rotenone 1 to 12,000 (0.5 cubic centimeter of a 10 per cent solution in acetone), and water to 600 cubic centimeters killed 73 per cent of the eggs sprayed with the mixture (p. 419).

Rotenone 1 to 1,000 (1 cubic centimeter of a 10 per cent solution in acetone) sirup 2 grams, and water to 100 cubic centimeters when sprayed upon the eggs gave a probable efficiency of about 93 per cent on account of larval mortality after hatching (p. 422).

No insecticide gives sufficient control to warrant recommending it.

GATER, B. A. R. (128)

NOTES ON MISCELLANEOUS INSECTS IN 1924. Malayan Agr. Jour. 13: 160–167. 1925.

The insect *Amsacta lactinea* Cram. (Arctiidae) has been recorded as attacking derris (p. 162).

——— (129)

ANNUAL REPORT OF THE ENTOMOLOGICAL DIVISION FOR 1924. Malayan Agr. Jour. 13: 220–226. 1925.

"Owing to difficulties in the identification of the species of Derris the position is in many ways hardly advanced from last year. From tests conducted on insects it appears that there are considerable differences in the toxicities of the various derris plants, but the unreliability of native names has rendered any accurate work impossible. Very shortly however, it is hoped that properly identified plants will be available for study. Some of the plants called 'Tuba' in Malay are not Derris, but a good collection has been made of all plants said to be poisonous to fish. The number of insects found feeding on the leaves of Derris is considerable, and may influence the production of these plants on commercial lines. The following have been found on the leaves:—Hesperiidae:—*Hasora alexis,* F. Arctiidae:—*Amsacta lactinea,* Cram. Geometridae:—*Anisodes obrinaria,* Guen. Limacodidae:—*Belippa laleana,* Moore. Thyrididae:—*Striglina scitaria,* Wlk. Pyralidae:—*Maruca amboinalis,* Feld., *Lamprosema diemenalis,* Guen, Eucosmidae:—*Eucosma defensa,* Meyr., and

GATER, B. A. R.—Continued.

E. balanoptycha, Meyr. In addition to these some roots have been found badly damaged by borers, but as yet they have not been investigated" (p. 224).

——— (130)

INVESTIGATIONS ON "TUBA." Malayan Agr. Jour. 13: 312–329. 1925.

"As an insecticide there are roughly three ways of applying Derris, viz: As a water 'extract' in the form of a spray, as a dust, and as a spray made by emulsifying with water an extract obtained by chemical means. The chemical extracts have not been used largely up to the present time owing to difficulties in extraction and the expense of the solvents used. Methods have lately been perfected, however, and we may expect to see concentrated extracts more widely used. The dust is not easy to obtain, and requires special machinery for its manufacture, but is efficient and easily applied. On estates which grow derris the water 'extract' is still the most convenient form of application, and the following is the method of preparation which has been found efficient in this country:—

Derris roots, 2–4 pounds; soap, 2 pounds; water, 10 [imperial] gallons. The derris is cut into small pieces and thoroughly pounded to a pulp. If a stone mortar or similar appliance is available a little water may be added to facilitate pounding. Five gallons of water are placed in a barrel or wooden tub and the derris pulp is enclosed in a cloth and steeped in the water, any 'extract' which remains from the pounding being added.

"The soap is sliced and dissolved in 5 gallons of water, using heat if necessary. When the soap has dissolved, the solution is put aside to cool, and the derris pulp is thoroughly squeezed until all the milky juice has been 'extracted.' The soap solution is now mixed with the milky fluid obtained from the derris. The stock solution is diluted at the rate of 1 in 10 of water. Iron containers should not be used.

"This spray will be found useful for general purposes, but for small soft-bodied insects less derris may be used. The actual amount necessary will depend to a certain extent upon the efficiency with which it is pounded and squeezed. The spray will not keep for more than two days without losing its efficiency. * * *

"The Malay word 'Tuba' is not confined to species of Derris. Eleven 'tuba' plants, not Derris species, were found to have no practical value as insecticides."

The mature larvae of *Parasa herbifera* Walk (Limacodidae) were used for these tests, being dipped for half a minute into a water extract of the plant to which one-fourth of 1 per cent sodium oleate was added.

"The species of Derris vary in toxicity, as do apparently varieties of the same species. *Derris elliptica* variety, tuba Rimba, appeared to be the best plant for use on estates. The larvae of a Pyralid, *Tirathaba* sp. were used in testing the different kinds of Derris. The larvae were for 50 seconds dipped into water extracts. Soap was not added.

"The following 13 insects feed on the leaves of Derris: *Parata alexis,* F.: *Amsacta lactinea,* Cram.; *Estigmene lactinea,* Cram.; *Creatonotus lactineus,* Cram.; *Anisodes obrinaria,* Guen.; *Mahasena* sp.; *Belippa laleana,* Moore; *Striglina scitaria,* Wlk.; *Lamprosema diemenalis,* Guen.; *Maruca testulalis,* Geyer.; *Maruca amboinalis,* Feld.; *Eucosma balanoptycha,* Meyr.; *Eucosma defensa,* Meyr. In addition, two species of Bostrichids, a Scolytid and a Tenebrionid, are known to feed on Derris roots.

"In order to ascertain whether the infested roots were really Derris species or those of some other plant which had been mixed with the Derris, a portion of the uneaten material was taken and an extract made in the usual way. This was then tested on some caterpillars and proved to be toxic. It had the typical appearance and smell of Derris extracts. A portion of the excreta from Bostrichid No. 2337, which was the dominant insect, was then taken and tested in the same way. The extract prepared from the excreta had no effect on other members of the same batch of caterpillars nor on the nymphs of *Dysdercus cingulatus,* F. which are particularly susceptible to Derris. It was thus concluded that the tubatoxin and other substances contained in the root were almost, if not entirely, destroyed by the digestive fluids of this insect."

GEOFFROY, E. (131)

CONTRIBUTION A L'ETUDE DU ROBINIA NICOU AUDLET. Ann. Inst. Colon. Marseille (1895) 2: 1–86, illus. 1895.

Robinia nicou Aublet from French Guiana contains a white crystalline substance (melting point 162°) called nicouline. Tests with this upon rats, rabbits, pigeons, flies, wasps, cockroaches, and other animals are described in detail. [This plant, now called *Lonchocarpus nicou,* is the cube of Peru, which Clark (*74*) has shown to contain rotenone. Geoffroy's nicouline is therefore rotenone.]

GEORGI, C. D. V. (132)

VARIATIONS IN THE AMOUNT OF ETHER EXTRACT OF TUBA ROOT. (DERRIS MALACCENSIS PRAIN). Malayan Agr. Jour. 17: 361–363. 1929.

The roots of the erect form of *Derris malaccensis* (Erect Sarawak) contain much more ether extract than do the roots of *D. elliptica.* On the moisture-free basis the fine roots contain a maximum of 34 per cent ether extract when 23 months old, and the coarse roots a maximum of 32 per cent at the same age. Both the erect and low-growing forms of this species are under cultivation at the government plantation, Serdang.

GEORGI, C. D. V., and CURTLER, E. A. (133)

THE PERIODIC HARVESTING OF TUBA ROOT (DERRIS ELLIPTICA BENTH.). Malayan Agr. Jour. 17: 326–334. 1929.

Exports of Derris species from the Federated Malay States during 1926 to 1928, inclusive, were as follows:

Year	Amount	Value (Malayan currency)	Value per pound (U. S. currency)
	Pounds	*Dollars*	*Dollars*
1926	54,548	24,175	0.248
1927	79,065	39,942	.283
1928	80,263	27,357	.190

Mentions that tuba is also being cultivated to a considerable extent in Johore, the estimated planted area for the year 1928 being 2,000 acres.

The distinctive vegetative characteristics of *D. elliptica* and *D. malaccensis* are described. In these tests derris was interplanted with kapok. The kapok trees were spaced 20 by 20 feet square. The tuba cuttings were planted in rows 3 feet apart and spaced 3 feet apart in the rows. This planting arrangement gave 3,555 plants per acre, as compared with 4,840 if the tuba had been planted as a sole crop. The roots were harvested at the end of 21, 23, 25, and 27 months. The following method of analysis was used:

The air-dry roots were cut into small pieces from one-fourth to one-half inch long, the mass being quartered until about 3 pounds remained. This sample was ground in a laboratory mill until it was reduced to a coarse powder, which was quartered again until approximately three-fourths to 1 pound remained. This quantity was ground and sieved until the whole of the material passed through a 0.5-millimeter sieve. Weighed quantities of the fine powder were taken for the determination of both moisture and ether extract.

Since tuba root undergoes decomposition if heated for any period, the moisture determination was made by drying the material over phosphorus pentoxide in vacuo to constant weight.

The quantity of ether extract was determined by treating the powder with ether in a Soxhlet extractor at a temperature just sufficient to allow the ether to boil. When extraction was complete the solvent was distilled off, and the residue dried to constant weight at 100° C. Although slight decomposition takes place by drying the ether extract in this manner, and the results are therefore slightly low, they will be comparable, since the same method was used throughout the investigation.

By coarse roots are meant those thicker than an ordinary size pencil. Fine roots are more acceptable on the London market, probably on account of the increased percentage of ether extract per unit weight of wood. The results of these tests are shown in Table 1.

TABLE 1.—*Derris elliptica roots*

Age of roots (months)	Yield per acre			Ether extract				
	Fresh roots	Moisture-free roots		Moisture-free basis		Fine roots per acre	Coarse roots per acre	Total roots per acre
		Fine roots	Coarse roots	Fine roots	Coarse roots			
	Pounds	*Pounds*	*Pounds*	*Per cent*	*Per cent*	*Pounds*	*Pounds*	*Pounds*
21	1,277	240	211	7.88	6.99	18.9	14.7	33.6
23	2,190	403	201	9.63	4.52	38.8	9.1	47.9
25	2,697	576	149	8.59	3.18	49.5	4.7	54.2
27	3,445	751	317	5.17	4.84	38.8	15.3	54.1

On the moisture-free basis 53 to 79 per cent of the total crop consists of fine roots. Moisture in the air-dry fine roots ranges from 7.9 to 11.6 per cent, and moisture in the air-dry coarse roots ranges from 9.6 to 16.5 per cent.

It is concluded that the optimum age for harvesting is when the plants are 25 months old.

GERSDORFF, W. A. (134)

A METHOD FOR THE STUDY OF TOXICITY USING GOLDFISH. Jour. Amer. Chem. Soc. 52: 3440–3445. 1930.

A method for using goldfish for the study of toxicity is described. The most suitable criterion is the death point. Ten or twelve fish should be used at each concentration. A series of tests at various concentrations should be made in order that survival time curves and velocity of fatality curves may be plotted. Rotenone

GERSDORFF, W. A.—Continued.

is more toxic to goldfish than is potassium cyanide, and the latter is two hundred times as toxic as phenol. A concentration of 0.075 milligram rotenone per liter (1 part in about 13,000,000) at 27° C. kills goldfish in two hours.

——— (135)

THE TOXICITY OF ROTENONE, ISOROTENONE, AND DIHYDROROTENONE TO GOLDFISH. Jour. Amer. Chem. Soc. 52: 5051–5056. 1930.

According to Powers's formula these substances have the following decreasing order of toxicity: Dihydrorotenone, 1.4; rotenone, 1; and isorotenone, 0.26.

——— (136)

A STUDY OF THE TOXICITY OF TOXICAROL, DEGUELIN AND TEPHROSIN USING THE GOLDFISH AS THE TEST ANIMAL. Jour. Amer. Chem. Soc. 53: 1897–1901. 1931.

According to Powers's formula these substances have the following decreasing order of toxicity to goldfish: Toxicarol, 0.65; deguelin, 0.56; and tephrosin, 0.23, as compared with 1 for rotenone.

GIBSON, A., chairman. (137)

REPORT OF THE COMMITTEE ON POLICY. Jour. Econ. Ent. 21: 19–22. 1928.

Under Substitutes for Nicotine, it is stated that various new spray mixtures containing extracts of pyrethrum and derris have been tested as substitutes for nicotine and the results have been favorable in most cases. Under Toxicity Investigations, it is mentioned that derris is one of the contact insecticides which have been investigated.

GIBSON, A. (138)

MOSQUITO SUPPRESSION IN CANADA IN 1927. N. J. Mosquito Extermin. Assoc. Proc. Ann. Meeting 15: 136–146. 1928.

Mr. Herman found that under laboratory conditions powdered derris root dusted on the surface of water in shallow trays at the rate of 15 pounds to the acre of water surface destroyed Aëdes larvae in a period ranging from 3 to 22 hours, and pupae from 2 to 5 days. In an experiment conducted by Mr. Twinn at Hawkesbury, Ontario, it was noted that when the powdered derris root was dusted on the surface of polluted pools of water heavily infested with *Culex pipiens* larvae, at the rate of 30 pounds to the acre of water surface, 97 per cent of the larvae were destroyed in 48 hours and 100 per cent in 72 hours.

In the discussion following this paper Doctor Headlee called attention to the fact that the dust resulting from grinding derris is extremely irritating to the mucous membranes of the nose and mouth.

——— (139)

MOSQUITO SUPPRESSION IN CANADA IN 1928. N. J. Mosquito Extermin. Assoc. Proc. Ann. Meeting 16: 102–108. 1929.

Like pyrethrum, derris when used in dust form is readily carried away by the wind. The field results from the use of this material were even less satisfactory than those from using pyrethrum.

A large semipermanent pool in open country containing a heavy infestation of mature larvae and some pupae of *Aedes stimulans*, *A. fitchii*, *A. excrucians*, and *A. cinereoborealis* was dusted with derris at the rate of 5 pounds per acre. At the end of 18 hours many larvae appeared sluggish and lacked control of their movements. In 48 hours there had been a marked reduction in the numbers. At the end of 72 hours the reduction in the infestation as compared to check pools was notable, the larvae visible also appearing rather inactive. In five days from the time of applying the derris, however, many larvae and pupae were still present and quite active, and adults were emerging. The result of the dusting was to materially reduce the infestation, but not sufficiently to compare favorably with the effect of oil.

Pools on the edge of scrubby woodland heavily infested with mature *Aedes vexans* larvae were dusted with derris, 8 pounds per acre. After 18 hours the larvae appeared as numerous as ever, and a considerable proportion were in process of pupating. In 48 hours the majority had pupated, and oiling was resorted to.

While the derris used in 1928 was not that used in 1927, both samples worked equally well in the laboratory, according to Mr. Herman, of Canada.

GILMER, P. M. (140)

DERRIS AS A PARASITICIDE. Minn. State Ent. Rpt. 19: 41–49. 1922.

Reports tests made with Derris powder furnished by the American Tobacco By-Products & Chemical Corporation, of Louisville, Ky.; also with a derris extract said to contain 16 per cent active derris and 84 per cent inert substances, apparently pyridine. The tests included the following: (1) Derris powder, 10 per cent; tobacco dust, 90 per cent. (2) Derris powder, 7½ per cent; tobacco dust, 92½ per cent. (3) Derris powder, 100 per cent; tobacco dust, 0 per cent. (4) Derris powder, 20 per cent; tobacco dust, 80 per cent. (5) Derris powder, 7½ per cent; tobacco dust, 67½ per cent; powdered sulphur, 25 per cent.

"The experiments were of two general types, those performed with the Derris powder as furnished, and those with the liquid Derris extract. The tests were made on cats, dogs, white rats, and chickens, fleas, lice, chicken lice, and cockroaches. The fleas included the rat flea, *Ceratophyllus fasciatus* Bosc., and the dog and cat

GILMER, P. M.—Continued.

fleas, *Ctenocephalus canis* Curt. and *C. felis* Rothse. The chicken lice included both the body louse, *Menopon biseriatum* Paiget, and the head louse, *Lipeurus heterographus* Nitzsch. The rat louse *Polyplax spinulosus* Burm. was the common louse of these animals. The cockroaches included the American roach, *Periplaneta americana* Linn., and the Croton bug, *Blatta germanica* Linn.

"Some work was done with liquid Derris. Its use upon animals is not recommended. The odor is very strong and repugnant to both animals and man, and the liquid is almost nonmiscible and must be used with some sort of emulsifying agent, such as soap, which makes it unhandy to prepare and use. As a spray for fruits and vegetables it seems to have no properties to recommend it above the ordinary insecticides. Its efficiency is a little below the better nicotine preparations, its cost is no less, and its preparation is more difficult. It does not mix well with sprays containing lime. It is, however, fairly effective and sticks well. Its effect if eaten with cabbage, lettuce, etc., is not known. It is very slightly toxic, although probably not to a sufficient extent to cause illness in human beings in the quantities likely to be consumed."

From the experiments it is concluded that derris furnishes a very efficient insecticide, particularly when used as a powder, against ectoparasites. It is effective, easily applied, not repugnant to the animal or man, and retains its insecticidal properties unaltered in the open air. It should be used about the same as pyrethrum powder, and in the 20 per cent derris-80 per cent tobacco-dust mixture has a killing power about as effective as that of commercial pyrethrum. Its stability in insecticidal power makes it superior to pyrethrum even at a slightly higher price. It seems, however, to lack the instantaneous effect of pyrethrum and is not effective aganist flies when blown into the air. As a check against roaches, ants, and insect ectoparasites, it is fully the equal of pyrethrum as ordinarily purchased.

GIMLETTE, J. D. (141)

MALAY POISONS AND CHARM CURES. Ed. 2, 260 p., illus. London. 1923.
[Poisons from jungle plants are described on pages 177–178, and poisons of vegetable origin on pages 208–223.]

A botanical description is given of *Derris elliptica.* The anatomy of the root is described. The roots of *D. elliptica* are frequently adulterated by the substitution of other roots, such as the aerial roots of the ficus tree. The rhinoceros and the porcupine can feed on the roots of tuba with impunity. The following account of fishing with tuba root is given. For this purpose the roots may be bruised with lime and tobacco.

It has been found by experiment that fish first become very lively, then for a while they are more responsive to a poke with a stick than are the controls. There are occasional spasms, and the respiration becomes slow. Thus, a gudgeon with a respiration rate of 106 per minute slowed down to 69 after 5 minutes, 46 after 45 minutes, and in 99 minutes breathing had ceased. Exposure to the poison for a while may be followed by death, even though the fish is transferred to fresh water. In frogs to which the poison is given by injection the heart is found gorged at apparent death, though a beat may be elicited by stimulation. There is also some slight response of nerve and muscle to direct stimulation, but the spinal cord is paralyzed.

H. E. Durham found in 1903 that the animals most sensitive to tuba root are perhaps the Daphnid crustacea. Tadpoles and water snails are also easily killed. Caterpillars are easily poisoned; especially sensitive is the gooseberry sawfly (*Nematus ribesii*), but Durham found that derris had no effect as a contact poison on the black bean aphis (*A. rumicis*) and the woolly aphis of the apple (*E. lanigera*). Trial on frogs' hearts showed that the vagus was paralyzed, so that stimulation of the nerve failed to cause the normal vagus inhibition.

In 1902 Durham started a series of experiments with tuba as a larvicide in the Federated Malay States. In England he found that Culex larvae (*Theobaldia annularis*) were killed by 1 in 40,000 suspension of the dried powdered crude root of *D. elliptica.* A solution of 1 in 10,000 killed the larvae in 29 hours and the pupae in 1 to 3 or 4 days. Another experiment with the larvae of *Culex pipiens* showed that they died in less than 16 hours (pupae in less than 24 hours) when treated with solutions of 1 in 1,000, 1 in 2,000, and 1 in 5,000 of the whole root. With 1 in 10,000 the larvae were killed in 20 hours and the pupae in 24. A solution of 1 in 1,000 of the extract is enough to make water cloudy.

Durham found that the very active constituent is in two forms, crystalline and resinoid. Both are highly toxic, but the resin is more active. Dilutions of 1 part in 4,000,000 or 5,000,000 parts of water will kill tadpoles within 24 hours, and in dilutions four or five times such strength only 3 or 4 hours elapse before death. Gudgeon exposed for four hours in two million fold dilution of the crystals did not recover in fresh water; 1 in 1,000,000 dilution of the resin, freed as much as possible from crystalline matter, killed a roach in four hours.

The crystals are beautiful, white, nonnitrogenous, crystalline bodies, consisting of carbon, hydrogen, and oxygen, with a definite melting point of 164½° C. They are soluble in petrolether and chloroform, benzine (sic), toluene, etc., but in water only to the extent of about 1 in 6,000,000. The pure crystalline form is not very soluble in cold alcohol, and thus it can be separated from the more soluble resinoid part of crude "derrid." The crystals (colorless long laminae, sometimes with small hexagonal plates, suggesting that they belong to the rhombic system) are altered and reddened by exposure to even diffused light, but keep well in the dark; they are also altered by too long heating with alcohol or other water-containing liquids. The resinoid form melts at about 61°. It is rather more soluble in water than the pure crystalline form. Thus, a saturated solution made by exposing the crystals to water for a week or two and then filtering will kill tadpoles when diluted fourfold but not tenfold, and a similar solution made from the resinous residue (which is probably not entirely freed from the crystalline substance) will kill at tenfold but not at twentyfold dilution.

The active matter is best extracted from the root by means of petroleum ether or hot paraffin (burning oil), from which on cooling it separates out as impure

GIMLETTE, J. D.—Continued.

resinous canary-colored masses. From these masses the crystalline body may be purified by extraction and recrystallization from alcohol. A characteristic color reaction is given by both the crystal and the resinoid derrid, according to Durham. Treated with a drop of strong nitric acid without heating on a glazed porcelain plate both become red, and then a drop of ammonia causes an evanescent deep rich peacock blue-green (signal green) coloration, fading to chocolate and yellow. Caustic potash after nitric acid gives a similar reaction, less lasting, passing to purple, then yellow. This is a distinctive reaction which might prove useful in criminal cases, as it is very sensitive. According to Campbell, it should be easy enough to detect the presence of tuba poison in the stomach contents by simply testing the effect, after boiling and filtering, of some of the fluid upon small fish, as they are killed by very weak solutions of the poison.

GINSBURG, J. M. (142)

INSECTICIDE INVESTIGATIONS. N. J. Agr. Expt. Sta. Ann. Rpt. 49, 336 p., illus. 1928.

A suspension of pyrethrum flowers, as well as an ether-alcohol extract of pyrethrum, when mixed with honey was found to be exceedingly toxic to honeybees. A suspension of derris (1–400) killed 100 per cent of the honeybees after 24 hours, and suspension of cube root (1–200) killed 100 per cent of the bees after 48 hours. Comparative tests with arsenic trioxide, caffeine, hellebore, nicotine oleate, 3, 5-dinitrocresol, and several other organic compounds are recorded (p. 158–163).

GLASGOW, H. (143)

MERCURY SALTS AS SOIL INSECTICIDES. Jour. Econ. Ent. 22: 335–340. 1929.

Five applications of derris dust at weekly intervals were ineffective in combating the carrot rust fly (*Psila rosae*). Mercurous and mercuric chloride were 100 per cent effective.

——— and GAINES, J. G. (144)

THE CARROT RUST FLY PROBLEM IN NEW YORK. Jour. Econ. Ent. 22: 412–416. 1929.

The same data on derris dust as presented in Glasgow's previous article (*143*).

GLASSFORD, J. (145)

THE ECONOMICS OF PYRETHRUM. Jour. Econ. Ent. 23: 874–877. 1930.

The two insecticides containing rotenone, derris from the East Indies and cube from South America, also promise to be useful vegetable insecticides. Derris contains 0.5 to 5.5 per cent of rotenone, and cube up to 7 per cent, with an average of about 4 per cent. Rotenone is said to be about equal to pyrethrin in toxicity. Commercial prices on these insecticides are not yet stabilized, but if they can be obtained as cheaply as it is hoped, finished sprays may possibly be made for from three-fourths of a cent to 1 cent per gallon.

A 1 per cent lubricating oil spray costs about 0.3 cent per gallon; a lead arsenate spray, 1.2 cents; a lime sulphur spray, 1.75 cents; a nicotine spray containing 0.04 per cent of alkaloid, 1.84 cents; and a pyrethrum spray, containing 0.04 per cent of oleoresin of pyrethrum and activated with soap, costs 2.2 cents per gallon.

GONGGRIJP, I. H. (146)

[COMBATING MITES IN HEVEA NURSERIES.] Meded. Alg. Proefsta. Alg. Ver. Rubberplanters Oostkust Sumatra, Rubber Ser. 67: 19. 1929. [Abstract in Expt. Sta. Rec. 62: 457. 1930.]

In comparative experiments with sulphur, akar-tuba, and Neoton the best and quickest results were obtained from the application of sulphur, and at a cost from one-third to one-fourth of that of the other materials.

GORHAM, R. P. (147)

THE EUROPEAN ROSE SAWFLY IN NEW BRUNSWICK. Ent. Soc. Ontario. Ann. Rpt. 58: 70–72. 1928.

Greenhouse experience has shown that the larvae are readily killed by spraying the underside of the foliage with an arsenical spray. The stain left on the foliage by the drying sprays, however, is objectionable to the florist. Trial, therefore, was made of dusting the leaves with ground derris dust during different larval instars. It was found that, like other sawfly larvae, these were very susceptible to the toxic action of this material and that they dropped in a helpless condition within two hours after application. No objectionable stains were left on the foliage or blooms.

GRAY, A. (148)

UNITED STATES EXPLORING EXPEDITION DURING THE YEARS 1838, 1839, 1840, 1841, 1842 UNDER COMMAND OF CHARLES WILKES, U. S. N. BOTANY. Phanerogamia, v. 1, 777 p. New York. 1854.

Derris uliginosa from Tongatuba, Fiji Islands, is described (p. 457).

GRESHOFF, M. (149)

CHEMISCH-PHARMACOLOGISCH LABORATORIUM EERSTE VERSLAG VAN HET ONDERZOEK NAAR DE PLANTENSTOFFEN VAN NEDERLANDSCHINDIË. Mededeelingen Uit 'S Lands Plantentuin VII. 127 p. Batavia. 1890.

Derrid, the active principle of *Derris elliptica*, begins to melt at about 61° C. and decomposes at 160° C. The roots contain 2.5 to 3 per cent active principle. Tests on fish (*Haplochilus javanicus*) weighing about 0.4 gram each are described. One part of derris-root decoction to 500,000 parts of water killed 100 per cent of these fish in 24 hours (p. 12–20).

——— (150)

BEITRÄGE ZUR CHEMISCH-PHARMAKOLOGISCHEN KENNTNIS INDISCHER LEGUMINOSEN (ERSTE SAMMLUNG). Mitt. Chem.-Pharmakol. Lab. Bot. Gart. Buitenzorg [Java]. Ber. 23:3537–3550. 1890.

Derris root contains about 2.5 to 3 per cent of the active principle called derrid. In a dilution of 1 part in 5,000,000 parts of water, derrid is poisonous to fish (*Cyprinus flavipinnis*) weighing about 40 grams.

An infusion of *Derris elliptica* in a dilution of 1 to 300,000 is poisonous to fish (*Haplochilus javanicus*) weighing about 0.4 gram. It contains a nonnitrogenous material which is easily soluble in alcohol, ether, chloroform, amyl alcohol, and similar solvents, but is very difficultly soluble in water and potassium hydroxide (p. 3538–3539).

The following data on the chemical composition are given: Crude derrid melts at 61° C., but decomposes when heated to 160°, giving off an odor resembling that of coumarin. Heated with caustic alkali, it yields salicylic acid and a little protocatechuic acid.

——— (151)

BESCHRIJVING DER GIFTIGE EN BEDWELMENDE PLANTEN BIJ DE VISCHVANGST IN GEBRUIK. (MONOGRAFIA DE PLANTIS VENENATIS ET SOPIENTIBUS QUAE AD PISCES CAPIENDOS ADHIBERI SOLENT). Mededeelingen Uit 'S Lands Plantentuin X. 201 p. Batavia. 1893.

Synonomy and use as fish poisons of *Derris elliptica, D. guianensis* and *D. uliginosa*. Gives many references (p. 58, 68–72).

——— (152)

NUTTIGE INDISCHE PLANTEN. Kolon. Mus. Amsterdam Afd. Extra Bul. 1896: [81]–129. illus. 1896.

A drawing of the leaves and flowers of *Derris elliptica* is shown. The synonomy, botanical characteristics, chemistry, and use as a fish poison are described. Gives many references (p. 98–103).

——— (153)

TWEEDE VERSLAG VAN HET ONDERZOEK NAAR DE PLANTENSTOFFEN VAN NEDERLANDSCH INDIË. Mededeelingen Uit 'S Lands Plantentuin. XXV. 199 p., illus. Batavia. 1898.

Derrid has the formula $C_{27}H_{26}O_8$, and a melting point of 204° C. A report on the crystallographic properties of the crystalline material from derris by A. W. Wichmann is given (p. 49–52).

——— (154)

MITTEILUNGEN AUS DEM CHEMISCH-PHARMAKOLOGISCHEN LABORATORIUM DES BOTANISCHEN GARTENS ZU BUITENZORG (JAVA). Ber. Deut. Pharm. Gesell. 9: 214–222. 1899.

Claims that Pfaff (*318*) and Von Sobieranski (Diss. Strassburg 1890) found timboin in the South American fish poison timbo, which comes apparently from *Derris negrensis Benth.*, and that Geoffroy (*131*) found nicouline in the Guiana fish poison nicou, which is a species of Lonchocarpus, and that Pool found a derridlike material in a fish poison from Surinam. Greshoff has isolated derrid from *Mundulea suberosa* Benth., also from Ormocarpum and Lonchocarpus.

——— (155)

TWEEDE GEDEELTE VAN DE BESCHRIJVING DER GIFTIGE EN BEDWELMENDE PLANTEN BIJ DE VISCHVANGST IN GEBRUIK. TEVENS: OVERZICHT DER HEROISCHE GEWASSEN DER GEHEELE AARDE EN HUNNER VERSPREIDING IN DE NATUURLIJKE PLANTENFAMILIËN. (MONOGRAPHIA DE PLANTIS VENENATIS ET SOPIENTIBUS QUAE AD PISCES CAPIENDOS ADHIBERI SOLENT; PARS. II.) Mededeelingen Uit 'S Lands Plantentuin XXIX. 253 p. Batavia. 1900.

Lists *Derris elliptica* Benth. as a fish poison (p. 174–175).

GRESHOFF, M.—Continued. (156)

DERDE GEDEELTE (SUPPLEMENT) VAN DE BESCHRIJVING DER GIFTIGE EN BEDWELMENDE PLANTEN BIJ DE VISCHVANGST IN GEBRUICK. TEVENS: OVERZICHT DER HEROISCHE GEWASSEN DER GEHEELE AARDE EN HUNNER VERSPREIDING IN DE NATUURLIJKE PLANTENFAMILIËN. (MONOGRAPHIA DE PLANTIS VENENATIS ET SOPIENTIBUS QUAE AD PISCES CAPIENDOS ADHIBERI SOLENT; PARS III.) Mededeelingen Uitgaande Van Het Department van Landbrouw No. 17. 370 p. Batavia. 1913.

Several species of Derris, including *elliptica* and *uliginosa,* are listed as fish poisons (p. 72–75).

GRIST, D. H. (157)

MARKETING OF DERRIS (TUBA ROOT). Malayan Agr. Jour. 14: 79–80. 1926.

Three large firms are using tuba, and various sheep dips and sprays have been placed on the market, the efficiency of which depends upon tuba root. Tuba root comes mostly from Borneo, where it can be bought more cheaply than in the Federated Malay States. At the end of 1925, 500 acres of tuba were under cultivation in the Federated Malay States and 600 acres in Johore. The price of the root in Singapore ranged from 10 to 12 cents a pound to about 25 cents a pound (in United States currency). The freight charge to England was nearly $100 a ton. Tuba root has been found to contain borers which not only eat the root but also destroy its toxic qualities. Fumigation of tuba before export will probably prove necessary. The author concludes that the cultivation of tuba in Malaya will show no advance until the difficulties attending the selection of the best varieties and the reduction of freight are overcome. In view of the fact that the market is restricted to a few buyers, there seems little purpose in advising the cultivation of this crop on estates.

——— (158)

DIVISION OF ECONOMICS—ANNUAL REPORT FOR 1927. Malayan Agr. Jour. 16: 114–130. 1928.

Reports that the acreage of derris in certain States of Malaya is as follows: Selangor, 40; Perak, 378; Negri Sembilan, 269; Pahang, 57; total for Federated Malay States, 744; Johore, 1,400; Kedah, 3; total for United Malay States, 1.403 (p. 117).

This comparatively little known insecticide is engaging the attention of investigators in various countries. Samples and trial shipments have been sent which it is hoped will eventually lead to established markets in various parts of the world. The inspector of agriculture for Johore advises that there is increased activity in the cultivation of this crop in Johore for export to Japan. American inquiry has been met with full information, which it is hoped may lead to business with that country.

GROSS, C. R., and FAHEY, J. E. (159)

SOME OF THE CHEMICAL PROBLEMS IN CODLING MOTH CONTROL. Northwest Fruit Grower 2 (32–33): 7, 22. 1930.

Refers to work on rotenone under way in the insecticide division of the Bureau of Chemistry and Soils and to tests made by F. L. Campbell, Bureau of Entomology, which indicate that rotenone as a stomach poison to silkworms is thirty times as toxic as is lead arsenate. Field tests at Yakima, Wash., in 1929, show that in low concentration rotenone was not so toxic to codling moth larvae as was expected.

HADDON, A. C. (160)

HUNTING AND FISHING REPORTS, CAMBRIDGE ANTHROPOLOGICAL EXPEDITION TO TORRES STRAITS. v. 4, 393 p., illus. Cambridge. 1912.

Parts of certain plants are scraped and pounded or bruised and placed in pools or lagoons on the reef at low water to stupefy fish, which are easily caught as they float on the surface. In Mer the process is called kublam and sad: kub is a fruit which is crushed and thrown into the water, turning it red; sad (eastern islands), zozi, or sazi (western islands) is a vine, *Derris uliginosa* Benth., that turns the water a milky white.

HALL, C. J. J., VAN. (161)

DERRIS ALS INSECTICIDE. Teysmannia 31: 159–166. 1920.

A review of the work of McIndoo, Sievers and Abbott, and others.

HALLER, H. L. (162)

ROTENONE. XI. THE RELATION BETWEEN ISOROTENONE AND ROTENONE. Jour. Amer. Chem. Soc. 53: 733–737. 1931.

Rotenonic acid in glacial acetic acid and sulphuric acid is isomerized to a substance which is insoluble in alkali and appears to be a saturated lactone. This compound, named β-dihydrorotenone, gives the typical reactions of rotenone. It yields a dehydro compound which adds 2 mols of water to form an acid. It gives a diketone. With potassium hydroxide it yields an acid isomeric with dihydrotubaic acid.

It is possible that when rotenone is isomerized to isorotenone, the double bond from the isopropylene group migrates to an α, β position to the lactone group and

HALLER, H. L.—Continued.

that the double bond becomes part of a conjugated system, which rearrangement might explain why isorotenone does not yield an acid on hydrogenation and why it is reduced only with difficulty.

——— and LAFORGE, F. B. (163)

ROTENONE. V. THE IDENTITY OF ISOTUBAIC AND ROTENIC ACIDS. Jour. Amer. Chem. Soc. 52: 2480–2483. 1930.

Isotubaic acid, $C_{12}H_{12}O_4$, prepared by refluxing an alcoholic potassium hydroxide solution of isorotenone, was found to be identical with rotenic acid, melting point 182°, which is derived from the isomeric tubaic acid by fusion with potassium hydroxide.

The change which occurs when rotenone is converted into isorotenone involves the same groupings as when rotenic acid is formed from tubaic acid.

——— and LAFORGE, F. B. (164)

ROTENONE. VII. THE STRUCTURE OF TUBANOL AND TUBAIC ACID. Jour. Amer. Chem. Soc. 52: 3207–3212. 1930.

An improved procedure for the preparation of tubaic and rotenic acids is given. Structural formulas are proposed for tubanol, rotenol, and tubaic, and isotubaic acids.

——— and LAFORGE, F. B. (165)

ROTENONE. IX. ALKALI FUSION OF SOME DERIVATIVES OF ROTENONE. Jour. Amer. Chem. Soc. 52: 4505–4509. 1930.

Derritol, isoderritol, rotenol, dihydroxyrotenonic acid, and isodihydroxyrotenonic acid on alkali fusion yielded isotubaic acid. Rotenonic acid, as well as several other derivatives of rotenone in which the lactone group was opened by catalytic reduction, did not give isotubaic or dihydrotubaic acid on fusion with alkali.

Compounds which gave isotubaic or dihydrotubaic acid contain the lactone group, or this group has been opened by hydrolysis. The conclusion is drawn that the hydroxyl group resulting from the opening of the lactone ring is necessary for the formation of isotubaic or dihydrotubaic acid. The fact that rotenol gives isotubaic acid contradicts the theory that cleavage of the molecule takes place at the ketone group. The nucleus of tubaic acid does not exist in derritol as such but is a secondary decomposition product. Perhaps it does not exist in rotenone.

HAMILTON, C. C. (166)

THE BOXWOOD LEAF MINER (MONARTHROPALPUS BUXI LABOU). Md. Agr. Expt. Sta. Bul. 272, p. 143–170. 1925. (Md. Agr. Expt. Sta. Ann. Rpt. 38, 1924–25.)

Describes tests with commercial preparation of derris against the boxwood leaf miner (*Monarthropalpus buxi* Labou). Derrisine diluted 1 to 500 was applied in a mixture of blackstrap molasses, 1 part to 4 parts of water. Both nicotine sulphate and free nicotine gave better control than the Derrisine.

HAMLYN-HARRIS, R., and SMITH, F. (167)

ON FISH POISONING AND POISONS EMPLOYED AMONG THE ABORIGINES OF QUEENSLAND. Mem. Queensland Museum v. 5, 22 p. illus. Brisbane. 1916.

Derris is included in Group A of fish poisons, namely, those that are effective and rapid in action at great dilution. Australian species described are *D. uliginosa* and *D. koolgibberah*. Toxicity tests upon fish with extracts from these plants are described. The presence of saponin is indicated in *D. koolgibberah*.

HANRIOT, M. (168)

SUR LES SUBSTANCES ACTIVES DU TEPHROSIA VOGELII. Compt. Rend. Acad. Sci. [Paris] 144: 150–152. 1907.

From the carefully shade-dried leaves of *Tephrosia vogelii* from the Iles Comores were obtained an oily liquid, tephrosal, and colorless crystals, $C_{31}H_{26}O_{10}$, melting point 187°, called tephrosine. The bromo derivative melts at 133°. The solubility of tephrosine in water, alcohol, acetone, chloroform, and glycerol is given.

——— (169)

SUR LA TOXICITÉ DES PRINCIPES DEFINIS DU TEPHROSIA VOGELII (LÉGUMINEUSES). Compt. Rend. Acad. Sci. [Paris] 144: 498–500. 1907.

Tests upon different species of fish, rabbits, and dogs with tephrosine are recorded. Tephrosine is much more toxic than tephrosal or the yellow bromo derivative of tephrosine.

——— (170)

SUR LE MODE D'ACTION DE LA TÉPHROSINE. Compt. Rend. Acad. Sci. [Paris] 144: 651–653. 1907.

The action of tephrosine when administered intravenously and intraperitoneally was tested upon rabbits, guinea pigs, and dogs.

HARRIS, E. L. (171)

TUBA FISHING IN THE PERAK RIVER. Amer. Foreign Serv. Jour. 2: 297–299, 318. 1925.

An account of fishing with tuba is given. Tuba is a root containing a vegetable poison which has a peculiar effect upon fish. It grows wild in the Malay Peninsula, and like creeping ivy it entwines itself around the wild fern trees of the jungle. When the root is broken up an odor is produced which somewhat resembles chloroform. It is prepared by mixing the sap with water and adding a bit of lime. The tuba is first pounded into a sort of pulp, and the milky juice which runs out is collected into a pit or possibly the bottom of a small boat or dugout and then finally mixed with the abraded root.

"The effects of the poison soon became apparent. Small-sized fish began coming to the surface and turn turtle with their bellies upward.

"As we descended the river the larger became the fish. The poison was getting in its work. The specific gravity of the tuba water, which is considerably heavier than that of river water, began to assert itself on the bottom of the stream, and the large fish had to take notice. The poison does not affect all species of fish alike. The carp seem to have the least stamina in resisting the poison. Long-whiskered catfish also stood no chance. Mudfish would bury themselves for safety deep in the mud, while perch frequently escaped by seeking shelter in the shallows. The great bulk of the fish, however, raced with the current in an endeavor to keep in front of the oncoming poison."

HARTWICH, C. (172)

DIE NEUEN ARZNEIDROGEN AUS DEM PFLANZENREICHE. Berlin. 1897.

The native names, habitats, and uses as fish poison, arrow poison, medicine, etc., are given for *Derris elliptica* Benth., *D. uliginosa* Benth., and *D. pinnata* Lour. *D. forsteniana* Bl. is mentioned as yielding a fish poison (p. 125).

——— and GEIGER, P. (173)

BEITRAG ZUR KENNTNIS DER IPOH-PFEILGIFTE UND EINIGER ZU IHRER HERSTELLUNG VERWENDETER PFLANZEN. Arch. Pharm. 239: 491–506. 1901.

Derris elliptica and *D. uliginosa* are listed among plants used to prepare arrow poisons. The anatomy of the root of *D. elliptica* is described.

HARTZELL, F. J. (174)

TOXICITY OF SPRAYS AND SPRAY INGREDIENTS ON PEAR PSYLLA NYMPHS. Jour. Econ. Ent. 23: 190–197. 1930.

A commercial pear orchard infested with nymphs of the five instars of the pear psylla (*Psylla pyricola* Förster) was sprayed by means of a large spray rig maintaining 350 pounds pressure. Derrisol (1½ pints per 100 United States gallons) alone was not very effective [59 per cent killed] but the addition of Bordeaux brought the killing efficiency equal [92 per cent killed] to that of the regular spray, which consists of 20 pounds copper sulphate, 40 pounds hydrated lime, and 1 pint of nicotine sulphate to 100 gallons water.

HARUKAWA, C. (175)

STUDIES ON THE RUSH SAWFLY, TOMOSTETHUS JUNCIVORUS ROHWER. Ber. Ōhara Inst. Landw. Forsch. 2: 521–544. 1925.

A whitish solution made from derris roots was supplied by an insecticide dealer. The method of preparation is unknown to the author. The author tested this solution on various insects and found that it seems particularly effective against the larvae of the rush sawfly. The tuba fluid diluted with one thousand times its volume of water killed 100 per cent of the larvae. Parallel experiments made with the tuba fluid diluted with soap water showed that there is practically no difference in effectiveness between the solution diluted with water alone and that diluted with soap water. The results of experiments are shown in tabular form (p. 541–542, 544).

HASEMAN, L. (176)

REPORT SUBCOMMITTEE ON INSECTICIDES AND APPLIANCES. Jour. Econ. Ent. 22: 13–15. 1929.

Combinations of oils and derris, pyrethrum, and nicotine have received further studies, and in some experiments these have given very effective results, though they are expensive. Pyrethrum, derris, and nicotine have been given special attention as remedies for pests of livestock and poultry and have proved satisfactory for some of the pests.

HASSELT, E. H. VAN (177)

OVER DE PHYSIOLOGISCHE WERKING VAN HET DERRID. K. Akad. Wetensch. Amsterdam, Verslag Wis en Natuurk, Afd. 19: 704–716. 1910. [Also in English. Roy. Acad. Sci. [Amsterdam] Sect. Sci. Proc. 13 (pt. 2): 688–699. 1911.]

Derrid is obtained by extracting derris roots (after the roots have been extracted with water, pressed, and dried) with 96 per cent alcohol. This alcoholic solution is evaporated and freed from fat by means of petroleum ether.

HASSELT, E. H. VAN—Continued.

Derrid has the composition $C_{33}H_{30}O_{10}$. It is soluble in alcohol, ether, chloroform, acetic acid, benzene, acetone, carbon disulphide, and ethyl acetate, slightly soluble in petroleum ether, insoluble in water, and very slightly soluble in 10 per cent potassium hydroxide solution.

Tests with eels, frogs, mice, dogs, cats, rabbits, and guinea pigs show that derrid acts upon the respiration center.

——— (178)

UEBER DIE PHYSIOLOGISCHE WIRKUNG VON DERRID, PACHYRHIZID UND NEKOE. Arch. Internatl. Pharmacodyn. et Thér. 21: 243–279. 1911.

Describes effects of derrid upon fish (*Gasterosteus pungitius*), frogs, mice, dogs, and cats. Derrid acts strongly upon the central nervous center, especially the respiration center.

HASSKARL, G. C. (179)

CATALOGUS PLANTARUM IN HORTO BOTANICO BOGORIENSI CULTARUM ALTER. Also Tweede Catalogus der in 's Lands Plantentuin te Buitenzorg Gekweekte Gewassen, 391 p., Batavia. 1844.

Lists *Pongamia uliginosa* (*Derris uliginosa*) (p. 283).

HAYNES, A. S. (180)

ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE, STRAITS SETTLEMENTS AND FEDERATED MALAY STATES FOR THE YEAR 1926. 17 p. 1927.

On page 11 it is said that there has been an extension of the area planted with tuba by Japanese in Johore. A further considerable area may possibly be planted on a European-owned estate in the near future.

Experiments are being conducted at Serdang to test the comparative values of different varieties of tuba in respect both to yield and to insecticidal properties.

The position of tuba on the world's market is studied. Through the efforts of the department various insecticide manufacturers have been persuaded to carry out experiments regarding the economic use of this product.

HELFRICH, C. (181)

SCHETS EENER GENEESKUNDIGE PLAATSBESCHRIJVING VAN DE ZUID—EN OOSTKUST VAN BORNEO. Geneesk Tijdschr. Nederland. Indië 7: 321–365. 1859.

An infusion of akar toeba (derris) is mentioned as an insecticide.

HENDREN, R. P. (182)

TUBA ROOT, PRODUCTION AND EXPORTS, SARAWAK. U. S. Dept. Com., Bur. Foreign and Dom. Com., World Trade Notes on Chemicals and Allied Products 5(4): 10. 1931.

Tuba (derris) root is being cultivated in Sarawak, Borneo, more widely than heretofore. The present area under cultivation is estimated at 2,000 acres, or almost double that of 1928. The next crop should approximate 3,125 tons of root, of which, after about one-third used by gardeners for spraying is deducted, 2,300 tons may be available for export. Tuba-root exports in 1928 amounted to 469 tons, whereas 704 tons, valued at $81,403, were exported in 1929, this being the largest amount ever shipped.

A British firm (McDougall & Co. (Ltd.)) formerly produced most of the tuba root in Sarawak for export to England. However, it is reliably reported that this firm will cease its operations in Sarawak at the end of 1930 to concentrate upon its extensive holdings in Johore. This firm is said to have heretofore financed the Chinese growers of tuba and to have taken over their crops when ready for export.

——— (183)

DERRIS (TUBA ROOT) CULTIVATION EXTENDING IN JAVA. U. S. Dept. Com., Bur. Foreign and Dom. Com., World Trade Notes on Chemical and Allied Products 5 (14): 7. 1931.

A Malayan resident in Batavia, Java, has reported that he has 2,000 acres planted to tuba root.

HEYNE, K. (184)

DE NUTTIGE PLANTEN VAN NEDERLANDSCH-INDIE. Ed. 2, 1662 p. (Dept. Landbouw, Nijverheid end Handel, Buitenzorg.) 1927.

The following species of Derris are described (p. 804–807), and native names and uses given: *Derris elliptica* Benth. (*Pongamia volubilis* Z. and M.); *D. heptaphylla* Merr. (*D. sinuata* Thw.); *D. heterophylla* Backer (*Dalbergia heterophylla* Willd., *D. trifoliata* Lour., *D. uliginosa* Benth.); *D. microphylla* Val. (*Brachypterum microphyllum* Miq., *Deguelia microphylla* Val.); *Derris polyphylla* K. and V.; and *D. scandens* Benth. (*Brachypterum scandens* W. and A.).

HINDS, W. E. (185)

DEPARTMENT OF ENTOMOLOGY. La. Agr. Expt. Sta. Ann. Rpt. 1925: 19–27. 1925.

The horn fly, as a pest on dairy cattle especially, has been controlled or repelled quite effectively by a method of spray treatment. The preferred formula consists of 1 pint of water and one-fourth pound of fish-oil soap, heated together until the soap is thoroughly dissolved. To this soap solution is added 1 quart of red pine oil. This mixture is brought to the boiling point and emulsified by pumping under pressure. To this emulsion may be added 30 cubic centimeters of Derrisine liquid or 90 cubic centimeters of free nicotine and 250 cubic centimeters of creosote. The entire mixture is fully emulsified by further pumping and forms the stock solution, 1 part of which is used with 12 parts of cold water to form the spray. This material was applied to cattle by a barrel pump connected with piping so that two nozzles were placed on each side of a chute through which the cattle were driven for treatment. The spray from the four nozzles formed a solid sheet of spray through which the cattle passed quickly. A very large proportion of the horn flies were hit by the spray before they could take flight (p. 26).

HOFFMAN, F.-LA ROCHE & CO. (186)

SCHÄDLINGSBEKÄMPFUNGSMITTEL. Swiss Patent 124290, issued January 16, 1928; applied for October 5. 1926.

Claim is made for an insecticide containing the dried, pulverized root of *Derris elliptica* or the crude or pure extract therefrom in an emulsified form. The following examples are given: (1) One part crude ether extract of the roots of *D. elliptica* and 2.5 parts of a 10 per cent ether solution of ozonized rape oil (obtained by treating 10 parts rape oil in 60 volume parts chloroform with ozone for 4 hours, distilling off the chloroform, taking up the residue in aqueous alcohol, and shaking the solution with ether) are dissolved in 30 parts alcohol, then treated with 10 parts ether, and, to facilitate production of emulsion, normal sodium hyroxide, until a reddish color is obtained by phenolphthalein. This solution is slowly and with constant stirring dropped into 60 parts distilled water at 70° to 80° C. Within certain limits the solution may be concentrated or diluted without the separation of the emulsified products. (2) One part crystallized rotenone, that is, the purified ether soluble principle of the roots of *D. elliptica*, together with 0.1 to 0.2 part cholesterinozonid, is dissolved in 20 parts acetone and 10 parts ether and treated with 10 parts alcohol, and in order to facilitate emulsification, sodium hydroxide, until faintly alkaline. The solution is dropped into 60 parts water at 70° to 80° with vigorous stirring. (3) One part rotenone and 0.1 part phytosterinoxide are dissolved in 12 parts alcohol and 4 parts ether and, to facilitate emulsification, made slightly alkaline with sodium hydroxide solution. The solution is slowly dropped with stirring into 50 parts water at 70° to 80°. (4) One part finely pulverized roots of *D. elliptica* and 0.1 part ozonized cholesterin are treated with hot alcohol, then with 10 parts ether, and the residue is filtered off. To facilitate emulsification sodium hydroxide solution is added until the reaction is faintly alkaline. The solution is slowly dropped into 60 parts distilled water at 70° to 80°, with vigorous stirring.

HOOKER, J. D. (187)

REPORT ON THE PROGRESS AND CONDITION OF THE ROYAL GARDENS AT KEW DURING THE YEAR 1877. London. 1878.

States that some tuba roots sent from Singapore by Colonel McNair grew and proved to be *Derris elliptica*. In Singapore water in which these roots have been steeped is said to be a very efficient insecticide for gardening purposes. The decoction also poisons fish (p. 43).

——— (188)

REPORT ON THE PROGRESS AND CONDITION OF THE ROYAL GARDENS AT KEW DURING THE YEAR 1878. London. 1879.

Mentions that a specimen of *Derris elliptica* (tuba) in the Royal Gardens at Kew flowered during the preceding year (p. 7).

——— (189)

THE FLORA OF BRITISH INDIA. v. 2, 792 p. London. 1879.

Twenty-three species of Derris are described, including *uliginosa* and *elliptica* (p. 240–248).

HOOVER, J. M. (190)

[LETTER TO THE EDITOR]. Agr. Bul. Straits and Fed. Malay States 9 (6): 128. 1910.

In a letter to the editor, Mr. Hoover states that a rubber plantation has been freed from white ants with tuba. This was prepared by heating the root and mixing it with water. Strong or weak, it does not effect the trees or other vegetation. If the case is not bad, the water is poured around the tree. If it is bad, the earth is taken away from the roots a little.

In a note in reply the editor, H. N. Ridley, states that tuba root has often been tried for termites with more or less success. It will eject them temporarily, but it is like other liquid insecticides—too easily washed out by rain. The pest then may return.

HOSE, C., and MCDOUGALL, W. (191)
THE PAGAN TRIBES OF BORNEO, 2 v., illus. London. 1912.

Fish are caught on a large scale by poisoning the water with the juice of the root of the tuba plant. This is usually practiced in the smaller rivers at times of slack water, all the people of a village cooperating. The tuba plant is cultivated in patches on the padi fields. Pieces of the roots are cut off without destroying the plants. When a large quantity has been gathered, a fence is built across the river at the spot chosen, and big bubu traps are let into it facing upstream. Then all the available small boats are manned and brought into the reaches of the river extending about a mile above the fence. Each boat carries a supply of tuba root, which the people bruise by pounding it with wooden clubs against stumps and rocks on the bank or against the side of the boat. Water is thrown into the bottom of the boat, and the pounded root is rinsed in the water, pounded again, and again rinsed, until its poisonous juice is extracted. The water in all the boats, milky with the juice, is poured at a given signal into the river, either by baling or by overturning the boats. After about 20 minutes the fish begin to rise to the surface and rush wildly to and fro. In the meantime the boats have been put to rights and now the people pursue the fish, the men armed with fish spears, the women with landing nets. The sport goes on for several hours. Some men armed with clubs stand upon a platform which slopes up at a low angle out of the water and rests upon the fence. Big fish leap upon this platform and are clubbed by the men, who have to exert their agility to avoid the spikes with which some of the fish are armed. Large quantities of fish are sometimes taken in this way. Those that can not be eaten fresh are dried and smoked over the fires in the houses.

While the tuba fishing is being arranged and the preparations are going forward great care is taken to avoid mentioning the word "tuba," and all references to the fish are made in oblique phrases, such as "The leaves (that is the fishes) can't float over this fence." This precaution is observed because it is believed that the birds and the bats can understand human speech and may, if they overhear remarks about the preparations, give warning to their friends the fish, whose magician (a bony fish called belira) will then make rain, and by thus swelling the river prevent the successful poisoning of the water (v. 1, p. 139–140; v. 2, p. 148–149).

HOUGH, W. S. (192)
A STUDY OF THE BIOLOGY AND CONTROL OF THE RED-BANDED LEAF ROLLER. Va. Agr. Expt. Sta. Bul. 259, 29 p. 1927.

Derrisol applied to the eggs of the red-banded leaf roller, *Argyrotaenia* (*Eulia*) *velutinana* Walker, with an atomizer at a strength of 1 to 800 did not give promising results (p. 20).

HOWARD, L. O. (193)
PREVENTIVE AND REMEDIAL WORK AGAINST MOSQUITOES. U. S. Dept. Agr., Bur. Ent. Bul. 88, 126 p. 1910.

Decoctions and emulsions of *Derris uliginosa* have been recommended for larvicidal use. Experiments conducted at the Wellcome Research Laboratories at Khartoum show that it also kills fish. Even in regions where these plants are native the different species of Derris have only a limited use as insecticides (p. 78).

——— (194)
REPORT OF THE ENTOMOLOGIST. U. S. Dept. Agr., Bur. Ent. Ann. Rpt. 1917, 24 p.

"Insecticidal constituents of plants have been studied in cooperation with the Bureau of Plant Industry. Additional poisonous plants have been obtained, and their toxicity and physiological effects on insects are being determined. * * * Studies of the comparative effect of pyrethrum, hellebore, and sabadilla on insects are well advanced, and experiments with a very promising product, one of the so-called fish-poisons, presumably 'Derris,' are being made" (p. 6).

——— (195)
REPORT OF THE ENTOMOLOGIST. U. S. Dept. Agr., Bur. Ent. Ann. Rpt. 1918, 24 p.

"Progress has been made in the investigation of the insecticidal constituents of plants, especially the so-called derris. This insecticide of oriental origin acts both as a contact and as a stomach poison. As a stomach poison it is efficient against only a few insects, while as a contact insecticide it is efficient against a wide range of insects. A detailed report on the subject is planned at the close of the growing season 1918" (p. 3).

——— (196)
REPORT OF THE ENTOMOLOGIST. U. S. Dept. Agr., Bur. Ent. Ann. Rpt. 1919, 27 p.

"Work on the so-called 'Derris,' an insecticide made from plants of the genus of this name, has been completed. If this insecticide can be obtained in sufficient quantities, it will prove an important addition to our list of substances that kill soft-bodied insects, such as plant-lice" (p. 8).

HOWARD, L. O.—Continued. (197)

REPORT OF THE ENTOMOLOGIST. U. S. Dept. Agr., Bur. Ent. Ann. Rpt. 1921, 33 p.

"A study has been made of the insecticidal constituents of plants, and 180 different preparations have been made from 46 different kinds of plants, excluding tobacco, quassia, and derris, the properties of these being generally acknowledged. Of the 180 preparations, only a few are worth further study" (p. 9).

——— (198)

REPORT OF THE ENTOMOLOGIST. U. S. Dept. Agr., Bur. Ent. Ann. Rpt. 1922, 32 p.

"Further tests with the little-known insecticide derris have been carried out and the results published. This material has been found to be very effective for use in the dust form against lice of cattle and other domestic animals as well as against fleas. The finding of an effective dry treatment for lice is a matter of much importance to the dairymen and stockmen of the North, where the use of sprays or dips is hazardous during the winter, when the lice usually become most troublesome. Thousands of dollars are spent each year for lice powders, and many of these are entirely ineffective" (p. 22–23).

——— (199)

REPORT OF THE ENTOMOLOGIST. U. S. Dept. Agr., Bur. Ent. Ann. Rpt. 1923, 37 p.

"A number of tests have been made with the destruction of the warbles in the backs of cattle by applying powders and washes. As a result of this work it has been found that over 98 per cent of the grubs can be killed with a general application to the backs of cattle of powdered derris root. A wash consisting of 1 pound of derris, 4 ounces of soap, and 1 gallon of water has also given a percentage of kill above 96. An ointment consisting of 1 part derris and 5 parts vaseline has also given almost 100 per cent kill when the material was pressed into each hole" (p. 29).

——— (200)

SOME RECENT DEVELOPMENTS IN MOSQUITO WORK. N. J. Mosquito Extermin. Assoc. Newark Proc. Ann. Meeting 11: 8–19. 1924.

"On January 28, 1924, Dr. Andrew Balfour, formerly Director of the Wellcome Research Laboratories in London, and now the Director of the Rockefeller School of Hygiene in London, passing through Washington on his way home from Bermuda, told me that Dr. T. A. Henry of the Wellcome Research Laboratories has during the past year isolated an active principle from *Chara foetida* which has been shown by Malcolm MacGregor, a former Carnegie student in this country and now of the field laboratory of the Wellcome Institution at Wisley, Surrey, England, to be toxic to mosquito larvae. In action, according to Mr. MacGregor, it appears to be somewhat similar to the well-known Malay fish poison, Derris" (p. 10).

——— (201)

REPORT OF THE ENTOMOLOGIST. U. S. Dept. Agr., Bur. Ent. Ann. Rpt. 1925, 35 p.

Further attention has been given to plants containing insecticidal properties, in cooperation with the Bureau of Plant Industry. Further investigations have been made of insecticides derived from derris, pyrethrum, and *Hura crepitans* (p. 5).

——— (202)

REPORT OF THE ENTOMOLOGIST. U. S. Dept. Agr., Bur. Ent. Ann. Rpt. 1927, 29 p.

Tests with insecticides against cattle grubs made at Burkes Garden in Virginia "indicate that certain tobacco powders of high nicotine content, free nicotine dust (1 to 3 per cent nicotine), and powdered derris root will give a high percentage of kill if applied and brushed in at intervals of about 20 days" (p. 23).

——— (203)

MOSQUITO WORK THROUGHOUT THE WORLD DURING 1927. N. J. Mosquito Extermin. Assoc., Atlantic City, Proc. Ann. Meeting 15: 6–15. 1928.

Refers to the work of Castillo (*71*) with three species of Derris against mosquitoes.

HOWES, F. N. (204)

FISH POISON PLANTS. Roy. Bot. Gard. Kew., Bul. Misc. Inform. 4: 129–153. 1930.

An interesting discussion of fish-poison plants according to geographical occurrence. Reference is made to articles on derris by Wray (*451*); Maxwell (*286*); Hose and McDougall (*119*); Oxley (*307*); Tattersfield and Roach (*405*); and McIndoo, Sievers, and Abbott (*276*). (*p. 139–140.*)

HUNT, T. F. (205)

INSECTICIDAL VALUE OF DERRIS. Calif. Agr. Expt. Sta. Ann. Rpt. 1922–23: 132. 1923.

Spraying and dusting experiments with the Indian fish-poison plant Derris were made by a senior student, L. T. White, under the direction of E. R. deOng. An extract of this plant known as Derrisine was unsatisfactory as an aphicide. Dilutions of 1 to 300 gave a 68 per cent efficiency, while 1 to 500 gave a control of but 50.5 per cent. It was also found inefficient against the red spider *Tetranychus telarius* Linn.

A dust made from ground derris root mixed with 80 per cent of inert carrier was found to give perfect control on the biting lice, *Menopon biseriatum* Piaget and *Goniocotes gigas* Taschenberg, of the fowl and on the sucking lice, *Gyropus ovalis* Nitzsch, and *Gliricola porcelli* Linn., of the guinea pig.

HYDE, A. M. (206)

REPORT OF THE SECRETARY OF THE UNITED STATES DEPARTMENT OF AGRICULTURE—1930. 92 p. Washington.

Attention is called to research under way in the United States Department of Agriculture on rotenone. This is being tested against the codling moth, the European corn borer, the Mexican bean beetle, aphids, and other destructive insects, with promising results (p. 64).

ISHIKAWA, T. (207)

INVESTIGATION OF TUBA, AN EAST INDIAN POISON FOR FISH. Tokyo Igakkwai Zasshi 30: 45–46. Japan. Med. Lit. 1 (pt. 2): 7–8. 1916. [In Japanese. Abstract in Chem. Abs. 11: 2370. 1917.]

Tuba is the Malay name of the plant *Derris elliptica*. It is commonly used by the natives of the East Indies for killing fish. Tubatoxin was isolated from the ethereal extract of the root obtained from Borneo. Its solution in alcohol yields pure white crystals, variable in shape, but mostly hexagonal or acicular. It is soluble in chloroform, ether, methyl alcohol, benzene, toluene, absolute alcohol, amyl alcohol, acetone, glycerol, petroleum ether, glacial acetic acid, and olive oil. It is insoluble in cold water, weak acids, and alkalies. It melts at 163.5° C., has the formula $C_{18}H_{18}O_5$, is not hygroscopic, burns with a peculiar odor when heated on platinum foil, and leaves no ash. It reduces ammoniacal silver nitrate and alkaline copper sulphate. It is not affected by cold concentrated alkalies, but it is destroyed by concentrated sulphuric acid and nitric acid. A solution of tubatoxin in glacial acetic acid gave a yellow color on the addition of 1 or 2 drops of fuming nitric acid, followed by dilution with water. When the resulting solution was added to dilute sodium hydroxide a ring appeared at the line of contact, colored green above and reddish brown below. This reaction is so delicate that it reveals the presence of 0.001 gram of tubatoxin.

The symptoms it produced in animals (fish, frog, rat, rabbit, and dog) were general motor paralysis with dyspnea of central origin. Blood pressure was first raised, then markedly depressed, and pulsation of the heart gradually ceased. The minimum lethal dose for the rabbit was 0.0009 gram per kilogram of body weight injected intravenously. On subcutaneous injection, tubatoxin was absorbed with difficulty.

——— (208)

[ÜBER ROTENON, EIN WIRKSAMER BESTANDTEIL DER DERRISWURZEL.] Tokyo Med. Jour. 31, no. 4. 1917. [In Japanese. Reviewed by Takei in Biochem. Ztschr. 157: 2. 1925.]

The author isolated from the roots of *Derris elliptica* colorless tablet crystals which he called tubatoxin. The melting point was 163.5°. It was soluble in organic solvents but not in water. In benzol solution the specific rotation was $[\alpha]\frac{29.5}{D} = -225.2°$. The empirical formula was $C_{18}H_{18}O_5$

JACK, H. W. (209)

RICE IN MALAYA. IX. PESTS AND DISEASES. Malayan Agr. Jour. 11: 157–161. 1923.

"The stem-boring insects which are particularly troublesome and cause much damage are *Schoenobius bipunctifer* and *Diatraea auricilia*. These besides killing the flowering shoots tend to retard the ripening of the crop or to break its uniformity, thus causing additional loss at harvest. The former is usually predominant, but the latter was more prominent in the earlier part of the 1921 season in the Krian district and had not been previously recorded as a pest of padi in Malaya. The preventive methods discussed for the control of the padi bugs already referred to are applicable to these borers also. In small areas the application of 'tuba' (the juice extracted from *Derris elliptica*) is most effective, but tuba can only be used where the padi is grown in water which is not mixed later with the drinking supply."

——— and SANDS, W. N. (210)

COTTON EXPERIMENTS IN MALAYA. Malayan Agr. Jour. 10: [248]–258. 1922.

Among the means recommended for controlling the cotton stainer is spraying with tuba mixtures and other sprays.

JACK, R. W. (211)
REPORT OF CHIEF ENTOMOLOGIST FOR 1928. South. Rhodesia, Sec. Dept. Agr. Rpt. 1928: 39–46. 1929.

Some experiments with top-dressing maize against borer (maize stalk borer, *Glottula fusca* Hmpsn.) were carried out with two proprietary insecticides and derris powder. All gave a satisfactory kill, but only the last named failed to scorch the plants.

JAGOR, F. (212)
SINGAPORE—MALACCA—JAVA. REISESKIZZEN. 252 p., illus. Berlin. 1866.

On pages 54–56 fishing with tuba is described.

JONES, H. A. (213)
THE DECOMPOSITION OF ROTENONE IN SOLUTION. Indus. and Engin. Chem. 23: 387–388. 1931.

Dry rotenone shows no decomposition on long standing, but in solution in organic solvents it is oxidized by atmospheric oxygen to dehydrorotenone and rotenonone, which are inert insecticidally. Rotenone changes least rapidly in solution in benzene and most rapidly in pyridine. In acetone the change is slow. For insecticidal use solutions of rotenone should be freshly prepared or else kept in air-tight containers.

——— and DAVIDSON, W. M. (214)
PREPARATIONS CONTAINING ROTENONE FOR USE AS INSECTICIDES. I. AQUEOUS SUSPENSIONS. Jour. Econ. Ent. 24: 244–257. 1931.

Good physical suspensions of rotenone result from the addition of pyridine solutions, or acetone solutions containing tannic acid, to water in the proper concentrations. Satisfactory suspensions may also be obtained from the use of mixtures of precipitated rotenone and suitable dry protective materials, such as the gums, saponin, or bentonite. Suspensions are more easily obtained in slightly alkaline than in acid media, but the former condition is not advisable due to the sensitivity of rotenone to the action of alkalies. It is difficult to obtain permanent suspensions in very hard water. Owing to the decomposition of rotenone in certain solvents, especially in pyridine and in acetone containing tannic acid, it is advisable to prepare the primary solution immediately before making the finished suspension or to make use of dry powdered preparations.

——— and SMITH, C. M. (215)
THE SOLUBILITY OF ROTENONE. I. SOLUBILITY AND OPTICAL ROTATION IN CERTAIN ORGANIC SOLVENTS. Jour. Amer. Chem. Soc. 52: 2554–2562. 1930.

The optical rotation at 20° of rotenone in 21 organic solvents has been found to range from −66° to −230°. The solubility at 20° of rotenone in these same solvents has been found to range from 0.2 to 33 per cent.

The solubility is very low in petroleum hydrocarbons, which are used extensively for spraying purposes.

Chloroform is the best solvent for rotenone. Some of the others tested are valuable in the following order: Ethylene dichloride, trichloroethylene, chlorobenzene, ethylene chlorohydrin, benzene, acetone, and toluene. The solubility of rotenone in the lower aliphatic alcohols is only about 0.2 gram per 100 cubic centimeters. It appears to be appreciably soluble in menhaden fish oil, and in steam-distilled pine oil.

JUNGHUHN, F. (216)
PLANTAE JUNGHUHNIANAE. Enumeratio plantarum, quas in insulis Java et Sumatra, detexit, Fasc. I et II, 522 p., London. 1853.

A botanical description of five species of Derris, including *D. uliginosa* is given (p. 251–254).

KALAW, M. M., and SACAY, F. M. (217)
SOME ALLEGED PHILIPPINE POISON PLANTS. Philippine Agr. 14: 421–427. 1925.

Derris trifoliata is included in a list of Philippine poisonous plants (p. 425). This is a poisonous vine useful as an insecticide and fish poison and is not very common.

KARIYONE, T., and ATSUMI, K. (218)
CONSTITUENTS OF DERRIS ROOT. Jour. Pharm. Soc. Japan no. 491, p. 10–17. 1923. [In Japanese. Abstract in Chem. Abs. 17: 3025, 1923; Chem. Zentbl. 94 (I): 1399–1400, 1923.]

Tuba, the root of *Derris elliptica*, is used to paralyze fishes, and its powder or extract was introduced as an insecticide. The chemical nature of tubatoxin, first isolated by Ishikawa from the root, is reported here. Six and sixty-five hundredths per cent crude tubatoxin was obtained by Ishikawa's method. It crystallized from alcohol in crystals. It melts at 163° C. and has the composition $C_{18}H_{18}O_5$. To study the nature of the oxygen, tubatoxin was treated with phenylhydrazine and glacial acetic acid on the water bath two hours. Yellow needles, $C_{17}H_{18}O_4{-}C{:}NNHPh$, with a melting point of 255°, were obtained. Since the oxime, melting point 245°, has also the composition $C_{17}H_{18}O_4C{:}NOH$, tubatoxin must have 1 carbonyl group. When tubatoxin was heated with an equal amount of anhydrous sodium acetate and 5 parts of glacial acetic acid for two hours at 140° it gave "diacetyltubatoxin" (?) needles, KARIYONE, T., and ATSUMI, K.—Continued.

melting point of which is not definite, and the saponification number of which is lower than the one calculated. Although the formation of the di-acetyl derivative is doubtful, tubatoxin has the power to utilize some alkali. With benzoyl chloride tubatoxin formed no benzoyl derivative; with phthalic anhydride, none of its ester was formed. Determination of methoxyl gave 1.5 with silver nitrate and 1.11 with dimethylaniline. Since tubatoxin and rotenone have similar properties (rotenone, $C_{18}H_{18}O_5$, melting point 163°; phenylhydrazone, melting point 243°), they are possibly identical. Tables are given to compare the properties of tubatoxin, rotenone, pachyrhizide and timboin, in respect to crystal form, melting point, composition, molecular weight, and melting point of the phenylhydrazones.

——— ATSUMI, K., and SHIMADA, M. (219)

THE CONSTITUENTS OF MILLETIA TAIWANIANA HAYATA. Jour. Pharm. Soc. Japan no. 500, p. 739–746. 1923. [In Japanese. Abstract in Chem. Abs. 18: 408, 1924; Brit. Chem. Abs. 43: B–31, 1924; Yearbook Amer. Pharm. Assoc. 13: 110, 1924.]

The "toba" roots of *Milletia taiwaniana* Hayata are used by Formosa natives to paralyze fishes as derris roots (*Derris elliptica*) are used in the South Sea Islands. In order to see whether rotenone isolated by Nagai (*299*) from this plant is the same as tubatoxin found in Derris roots, the authors prepared rotenone according to Nagai's method. From air-dried roots, 0.93 per cent crude rotenone was obtained mixed with waxy impurities that could be removed by successive washings with petroleum ether (boiling point 50°–75° C.), and benzene. The pure rotenone thus prepared melted at 163°, had the formula $C_{18}H_{18}O_5$, and $[a]\frac{20}{D} = -244°$ (in benzene solution). These properties are exactly the same as those of tubatoxin. The physical properties of their oxime and phenylhydrazone are also similar. Microscopic examination shows that rotenone and tubatoxin both form hexagonal crystals when crystallized out from hot alcohol whose $a:b:c = 1.1650:1:0.4245$. From benzene solution, both rotenone and tubatoxin give needle crystals. A mixture of rotenone and tubatoxin gives the same melting point. The waxy substance is amorphous and melts at 80°. It gives no cholesterol reaction, has the acid number 15.97, and the saponification number 33.92. After acetylation the saponification number is 118.7, the Hübl number is 17.03, and the acetyl derivative melts at 65°. Thus rotenone and tubatoxin must be the same, and the different pharmacological action of rotenone and tubatoxin (*208*) must be due to an impurity in rotenone. The name tubatoxin, therefore, should be replaced by rotenone on account of priority of the latter.

——— and HADANO, M. (220)

UNTERSUCHUNG ÜBER DIE BESTANDTEILE DER DERRISWURZEL (IV). Jour. Pharm. Soc. Japan no. 580, p. 542–545. 1930. [In Japanese. Abstract in Chem. Abs. 24: 4785. 1930.]

Resorcinol is obtained by alkali fusion of rotenone, rotenic acid, rotenic acid methyl ether, and dihydrotubaic acid. Alkali fusion of rotenone also yields a phenolic substance boiling at 146° C. to 149° under 8 millimeters' pressure, corresponding to the rotenol of Takei. The parasulphonyl derivative melts at 102°–103°. The authors prefer Butenandt's structural formula for tubaic acid to that proposed by Takei.

——— KIMURA, Y., and KONDO, K. (221)

CONSTITUENTS OF DERRIS ROOT. II. Jour. Pharm. Soc. Japan no. 514, p. 1049–1060. 1924. [In Japanese. Abstract in Chem. Abs. 19: 1708, 1925; Chem. Zentbl. 96 (I): 1751, 1925.]

By further analysis of rotenone, an active insecticidal principle of the root of *Derris elliptica*, it is shown that $C_{19}H_{18}O_5$ is correct instead of $C_{18}H_{18}O_5$ (*219*). A further attempt to identify the OH group by acetyl or benzoyl compounds failed. When treated with methyl magnesium iodide according to Chugaev and Zerevitinov, it has no methane. According to Van Sillevoldt (*366*), when hydrogen chloride gas is passed into an alcoholic solution of derrid (impure rotenone) 2OH groups split off $1H_2O$, forming an anhydro derivative, and Ishikawa (*208*) reported the same results with pure rotenone. The authors, however, failed to obtain any anhydro derrid, either by passing hydrogen chloride into pure rotenone in cold or hot alcohol or by heating it with hydrogen chloride in a sealed tube. What they found was a compound, $C_{19}H_{19}ClO_5$, melting at 193°, needles of which are in general less soluble than rotenone. By a similar method is obtained a bromide $C_{19}H_{19}BrO_5$, melting at 185°. In each case the halogen content is slightly less than the theoretical. In order to determine whether this halogenation is an indication of the presence of a double bond in the rotenone, catalytic reduction was tried with palladium barium sulphate in ethyl acetate. The result shows an absorption of 1 molecule of hydrogen, producing dihydrorotenone, $C_{19}H_{20}O_5$, melting at 216°, $[\alpha]\frac{29}{D} = -222.2°$ (in benzene), and $-94.3°$ (in chloroform). This dihydro derivative does not take up hydrochloric acid, but forms an oxime melting at 258°. Takei (*386*) obtained an acid, $C_{10}H_{10}O_3$, melting at 129°, by treating rotenone with alcoholic potassium hydroxide and another acid, $C_9H_{10}O_3$, melting at 182°, by alkali fusion, the latter being named rotenic acid. By alcoholic potassium hydroxide treatment the authors obtained an acid which melts at 129° and has the composition $C_9H_{10}O_3$. This is tubaic acid, which should be differentiated from rotenic acid, that has the same empirical formula but melts at 182°. Tubaic acid gives a purplish-red color with ferric chloride and forms a monoacetyl compound, melting at 132°, and a

KARIYONE, T., KIMURA, Y., and KONDO, K.—Continued.

monomethyl ester, melting at 54°. The former gives no color with ferric chloride, but the latter does. It has $[\alpha]\frac{29.5}{D} = -90.8°$, gives a dihydro derivative $C_9H_{12}O_3$ by catalytic reduction, and is an isomer of dimethyl salicylic acid, but is a different compound from this acid. Dihydrotubaic acid, melting at 166°, gives a purple color with ferric chloride and has $[\alpha]\frac{31}{D} = -105.3°$. Its monoacetyl derivative, melting point 168°–169°, gives no color with ferric chloride, but the monoethyl ester, melting point 79°, gives purple color with the same reagent. This dihydrotubaic acid can also be obtained by boiling dihydrorotenone with alcoholic potassium hydroxide.

The reports of experiments with derris root and its active principle in dermatological cases with certain parasitic infection are included.

——— and KONDO, S. (222)

TUBAIC ACID. Jour. Pharm. Soc. Japan no. 518, p. 376–379. 1925. [In Japanese. Abstract in Chem. Abs. 19:2485, 1925.]

According to Takei, tubaic acid (melting point 129°), obtained by treating rotenone with alcoholic potassium hydroxide, has the composition $C_{10}H_{10}O_3$, but the authors found it to be $C_9H_{10}O_3$. (*386.*) Reanalysis of this acid, with a larger quantity, gives the composition $C_{12}H_{12}O_4$, which is also confirmed by reanalysis of the acetyl derivative. Thus dihydrotubaic acid should be $C_{12}H_{14}O_4$. According to Takei, a compound obtained by alkali fusion of rotenone or tubaic acid is $C_9H_{10}O_3$ and was named by Takei rotenic acid. The authors found that this compound is $C_{12}H_{12}O_4$, and is an isomer of tubaic acid. The analysis of its monoacetyl derivative obtained by heating the compound with sodium acetate and acetic anhydride also confirms the correctness of this formula. This compound, therefore, could not be a dimethylsalicylic acid, as suggested by Takei.

——— and KONDO, S. (223)

NOTIZ ÜBER DIE TUBASÄURE. Jour. Pharm. Soc. Japan no. 519, p. 4–5. 1925. [In Japanese. Abstract in Chem. Zentbl. 96 (II): 829, 1925.]

The composition of tubaic acid is $C_{12}H_{12}O_4$. Rotenic acid, the melting point of which is 182°, is obtained through a caustic potash fusion of rotenone or tubaic acid. Rotenic acid is an isomer of tubaic acid. Acetyl rotenic acid needles melt at 154°.

——— KONDO, S., and MAKABE, K. (224)

CONSTITUENTS OF DERRIS ROOT. III. TUBAIC ACID. Jour. Pharm. Soc. Japan v. 48, p. 674–678. 1928. [In Japanese. Abstract in Chem. Abs. 23: 382, 1929; Chem. Zentbl. 99 (II): 1338, 1928.]

In Paper II (Chem. Abs. 19: 1708) it was reported that tubaic acid, $C_{12}H_{12}O_4$, is a monohydroxymonocarboxylic acid containing one double bond. In order to determine the exact position of the double bond the ozonide reaction of tubaic acid was studied. Tubaic acid with methyl iodide and silver oxide, and subsequent saponification with alcoholic potassium hydroxide, gave tubaic acid methyl ether, $C_{13}H_{14}O_4$, having the melting point 78°, and this with hydrogen and palladium-barium sulphate gave the dihydro derivative, melting point 101°, which was also obtained by methylation of dihydrotubaic acid. The trinitro derivative of the dihydro derivative has the melting point 133°. Tubaic acid methyl ether and ozone and subsequent decomposition of the ozonide with water gave an aldehyde acid, $C_{12}H_{12}O_5$, having the melting point 98.5°. This reaction shows that tubaic acid should have a $CH_2:CH-$ group attached at the end of a side chain so that the reaction can be expressed by: $-CH_2:CHC_9H_7O(OMe)CO_2H \rightarrow OHCC_9H_7O(OMe)CO_2H$. Of 4 oxygen atoms, 2 belong to the CO_2H group and 1 belongs to the OH group. The remaining oxygen atom probably forms an ether linkage. An attempt to obtain a compound devoid of OH and CO_2H groups in order to study the nature of the remaining oxygen atom was unsuccessful. Boiling of dihydrotubaic acid with hydrobromic acid gave dihydrotubanol, melting point 121°. The monoacetyl derivative melts at 63°. Dihydrotubaic acid and phosphorus pentachloride and subsequent decomposition with water gave chlorodihydrotubaic acid, melting point 201°. Reduction of the aldehyde acid, melting point 98.5°, with hydrogen and palladium gave desoxydihydrotubaic acid, $C_{11}H_{13}OCO_2H$, melting point 192°. Boiling of chlorodihydrotubaic acid with hydriodic acid gave chlorodihydrotubanol, boiling point 111° to 112°. The molecular refraction (54.34) of this indicates the presence of at least three double bonds. The above-described reactions show that tubaic acid has the structure $C_9H_7(-CH:CH_2)(-OH)(-CO_2H)(>O)$.

KELSALL, A., SPITTALL, J. P., GORHAM, R. P., and WALKER, G. P. (225)

DERRIS AS AN INSECTICIDE. Ent. Soc. Ontario Ann. Rpt. 56: 24–40. 1926.

The authors review the chemistry and economics of derris. Tests upon the Colorado potato beetle (*Leptinotarsa decemlineata* Say.) with derris in 4–4–40 Bordeaux. derris and hydrated lime, and derris alone lead to the following conclusions: Derris is effective in both spray and dust form; derris kills more rapidly than arsenicals; derris is apparently less effective mixed with hydrated lime, and still less effective mixed with Bordeaux mixture. To get the same eventual kill, 1 pound of derris is apparently about equivalent to from 1½ to 3 pounds of calcium arsenate.

A 5 or 6 year old sample of derris was ineffective against the forest tent caterpillar (*Malacosoma disstria Hon.*) when dusted or sprayed upon chokecherry foliage fed upon by the caterpillars.

Tests were also made upon the orchard tent caterpillar (*Malacosoma americana* Fab.); the imported currant worm (*Pteronus ribesii* Scop.); the house fly (*Musca*

Kelsall, A., Spittall, J. P., Gorham, R. P., and Walker, G. P.—Continued.

domestica); the carrot rust fly (*Psila rosae* Fab.); clothes moths; bedbugs (*Cimex lectularius* L.); bud moths (*Spilonota ocellana* Schiff.); fall webworm (*Hyphantria cunea* Drury); green apple aphis (*Aphis pomi* De G.); potato aphis (*Macrosiphum solanifolii* Achm.); *Aphis rumicis* L.; the imported cabbage worm, and against miscellaneous pests.

Undiluted derris dust, applied with a hand duster, gave 100 per cent control of larch sawfly larvae. Derris dust had apparently no effect on Chermes. The 3-lined potato beetle was controlled by a dust application of derris and hydrated lime in equal proportions. The same mixture had apparently no effect on the squash bug. A red aphis on goldenrod and the currant aphis were not controlled on being dusted by the same mixture, but by reasoning from other experiments it is possible they might have been if in the presence of moisture. Derris, both dust and spray, gave a measure of control against the larch case borer but was ineffective against the chain dotted geometer. Arsenicals were practically ineffective against them also.

Derris, 1½ pounds per 100 imperial gallons water, with the addition of soap, was used against aphids on a cutleaf birch. Geometrid larvae, ladybird-beetle larvae, and syrphid-fly larvae were killed and dropped in a few hours, but the aphids did not appear to be affected during the first 12 hours. Two days later the tree was found to be completely free of aphids.

Derris was not effective in a bait fed to cutworms, either in the insectary or in the field. It was noted in some cases that when dusts containing derris had been supplied to plants, and later rains had washed the dust into the soil, earthworms came to the surface of the soil and died.

Derris, applied at approximately the rate of 1 pound per 100 imperial gallons, added to a large tank of water very heavily infested with mosquito larvae, killed all the larvae in three or four days. It was also noted that if slugs traveled over a surface on which derris had been lightly sprinkled, they immediately became distressed and died in a few hours.

Derris, used undiluted, and 1 part to 3 parts dry cement powder was found very effective against lice on cattle and horses.

"Besides all the insects utilized by us, it is well known that derris has been very successfully used as the insecticidal ingredient of certain proprietary sheep dips.

GENERAL CONCLUSIONS

"During the next few years Derris will probably be available in quantity, and at prices competitive with other insecticides. It is a very effective insecticide over a wide group of insects, but by no means effective against all insects. It kills very largely by contact with the external surface of the insect.

"When used against insects on plants, derris is effective both as a spray and as a dust, but is generally more effective as a spray, and when used as a dust is generally more effective under moist conditions.

"Derris has physical properties which make it good for dusting purposes. For spray purposes it is advisable to make into a paste with a small quantity of water preparatory to diluting.

"Used on a number of varieties of plants, and used at much greater strength than is necessary, no foliage injuries on any plant were observed following its use.

"As the material is practically nonpoisonous to man, it should be especially useful where it is desired to make an application to food products, such as cabbages, and currants within a short time of use."

Kendall, P. F. (226)

DISCUSSION OF DERRIS ELLIPTICA AT THE EVENING MEETING IN EDINBURGH (JANUARY 22, 1926) OF THE PHARMACEUTICAL SOCIETY OF GREAT BRITAIN. Chem. Drug. 104 (2401): 161; Pharm. Jour. and Pharm. [London] 116 (3250): 113. 1926.

The root of *Derris elliptica* may possibly replace Paris green as an insecticide. It is used in the making of at least one kind of sheep dip as a remedy against sheep scab. The root of *D. elliptica* appears to be nonpoisonous to human beings.

Killip, E. P., and Smith, A. C. (227)

THE IDENTITY OF THE SOUTH AMERICAN FISH POISONS, "CUBE" AND "TIMBO." Jour. Wash. Acad. Sci. 20: 74–81. 1930.

The plant *Lonchocarpus nicou* (Aubl.) DC. is called cube or cubi about Huancayo, Peru, and southward; and conapi, pacai, barbasco legitimo, or simply barbasco, in northern Peru. In Brazil the word "timbo" is used for fish poisons in general, the barbasco legitimo of Peru becoming timbo legitimo. In British Guiana cube and other fish poisons are known as haiari; in French Guiana the word "nicou" is similarly employed. Cube is extensively cultivated and is said to be the most powerful of the fish-poisoning plants.

Other species of Lonchocarpus cultivated as fish poisons are *L. floribundus* and *L. urucu*, called timbo urucu by the Brazilian natives. Botanical descriptions and illustrations of the three species of Lonchocarpus are given.

King, G. (228)

MATERIALS FOR A FLORA OF THE MALAYAN PENINSULA. (Reprinted from Asiatic Soc. Bengal Jour. 66 (Pt. 2, no. 1): no. 9, 345 p. Calcutta. 1897.

Gives a botanical description of *Derris elliptica* and *D. malaccensis* from the Malay peninsula (p. 106–107).

Kingzett, C. T. (229)
CHEMICAL ENCYCLOPAEDIA. Ed. 4, 807 p. London. 1928.

A brief description of derris root (*Derris elliptica*) as an insecticide is given. It is said to be the source of a number of dusting-powder preparations advocated for use as more or less nonpoisonous to human beings (p. 383).

Kirby-Smith, J. L., Dove, W. E., and White, G. F. (230)
CREEPING ERUPTION. Arch. Dermatol. and Syphilol. 13: 137–173. 1926.

Applications night and morning of an ethyl acetate extract of derris were effective in five old cases of creeping eruption. [This is caused by the migrations, under the skin, of the third-stage larva of one of the dog and cat hookworms (*Ancylostoma braziliense*).] In well-selected cases splendid results have been obtained with ethyl acetate alone.

Knight, H. G. (231)
REPORT OF THE CHIEF OF THE BUREAU OF CHEMISTRY AND SOILS. U. S. Dept. Agr., Bur. Chem. and Soils Ann. Rept. 1929, 42 p.

It is stated on page 21 that work has been continued during the year on the chemical constitution of rotenone.

——— (232)
REPORT OF THE CHIEF OF THE BUREAU OF CHEMISTRY AND SOILS. U. S. Dept. Agr., Bur. Chem. and Soils Ann. Rpt. 1930, 67 p.

Cube root from Peru has been chemically examined and found to contain about 7 per cent rotenone, the chief insecticidal constituent of derris root. Timbo from Brazil has also been found to yield rotenone. Interest in rotenone has greatly increased as the result of the bureau's activities, and it is believed that within the coming year many proprietary insecticides manufactured within the United States will contain rotenone as the essential insecticidal constituent (p. 31–32).

Kopp, A. (233)
LES DERRIS INSECTICIDES. Rev. Bot. Appl. et Agr. Colon. Bul. 34, v. 4, p. 400–402. 1924.

Derris powder has given excellent results against plant louse; Pucerons du Pommier (1 livre (500 grams) to 800 liters water containing 1 kilogram soap): Malacosoma; larvae of *Hyphantria carnea; Anisota senatoria* (500 grams to 100 liters containing 250 grams soap); *Datana ministra* (500 grams to 200 liters); *Autographa brassicae* (500 grams to 100 liters); *Lygidea mendax; Heterocordylus malinus;* Doryphora of the potato.

Kuijper, J. (234)
AKAR TOEBA (DERRIS ELLIPTICA) HET BESTRIJDINGSMIDDEL VAN DE TABAKSLUIS (MYZUS PERSICAE) IN DELI. Meded. Deli Proefsta. Medan Ser. 2, no. 58, p. 3–61, illus. 1929.

On several estates of the Deli tobacco district the attacks of *Myzus persicae* cause serious losses. In recent years spraying with tuba-root extract has proved to be the best and most economical way of fighting this pest. A botanical description is given of *Derris elliptica*. Two species of Derris seem to be planted in Malacca, *elliptica* (tuba puteh) and *malaccensis* (tuba merah), the former being the more common. Of both species some varieties are supposed to exist, showing great difference in quantity and quality of the latex. The water content of fresh roots runs up to 40 per cent.

In the manufacture of tuba-root extract the dried root is chopped into pieces of 1 to 2 inches and mixed with six times its weight of water; when the roots are fresh less water is added. It is crushed for 20 to 30 minutes by vertically running millstones, then thoroughly sieved, and the residue pressed by a hydraulic press. The liquid pouring out of this press passes through a fine sieve and is mixed with the first extract. The liquid is then disinfected with 0.5 per cent of formalin, and when put in tightly sealed casks it may keep for some months. This method is satisfactory for the Deli conditions, for the extract is made only during the planting season, and therefore is used within a short time. Because the extraction with water is cheap and no expensive concentrating and preserving process has to be done, it is by far the cheapest insecticide for the Deli planters. This stock solution should be diluted with 50 parts of water before being sprayed. An average of 60,000 liters of this stock solution is sent annually to the estates.

"As chemical methods for testing the aphicidal properties of the liquid are not simple and convenient, a biological method has been used. The piscicidal effect can easily be controlled in the following way: Into a spacious jar, filled with 1 liter of water and containing a small fish (*Trichopus trichopterus*), a known quantity of the extract is poured. The opalescent liquid is then thoroughly stirred. The time in seconds (T) before the fish succumbs is carefully noted. A series of 4–6 fishes is used for each test. Previous to accepting this method a biological control of several experiments has been carried out in order to learn in which way T was influenced by the body weight of the fish (G) and the temperature of the test liquid in the jar. It was clearly demonstrated by these preliminary experiments that a correlation between T, G. and the temperature of the test liquid (if not otherwise stated, by test liquid a dilution of 10 c. c. extract in 1,000 c. c. water is understood) does really exist. Thus the fishes used in our experiments first had to be divided in different classes according to their body weight (1–1.99 grams, 2–2.99 grams, 8–8.99

Kuijper, J.—Continued.

grams), whereafter T was determined for each class at a definite temperature of the test liquid (room temperature 26.5° to 28°).

"We note that T increases as G increases. However, by substituting the different values of T and G, obtained empirically in our experiments, in the formula $\frac{T}{G}=PQ$ (piscicidal quotient), we find that PQ decreases if G increases, thus tending to show that at a given temperature (that is, room temperature) small fishes withstand submersion in the test liquid relatively longer than large fishes. The toxic action of the test liquid increases as the temperature of the test liquid rises. The extract has a tendency to flock out. Heating the extract affects its toxicity to fish, but to a slight degree. Old and putrefying extract has a diminished value against aphids. The alcoholic extract is more toxic to fishes than the water extract, but the water extract is cheaper. An extract of stems and leaves of *Derris elliptica* showed no toxicity towards fishes.

"Two sets of experiments were conducted in order to determine the aphicidal properties of both akar tuba (1–2½ per cent) and sulphate of nicotine (1–3 per cent) on *Myzus persicae* Sulz. In the first set, tobacco leaves with at least 300 insects were dipped twice into the solution (suspension), which was to be tested and then placed in Petri dishes. Counts were made after 24, 48, and 72 hours. The results show that akar tuba works at least as effectively in the concentrations tested as sulphate of nicotine, though perhaps somewhat more slowly. Moreover, these results indicate that the killing power may be intensified by adding 0.1 per cent of soap.

"The second set of tests had the character of a field experiment. Tobacco plants were sprayed and after 48 hours counts were made on the third and sixth leaf from the top. Only the surviving adults were counted. The results show a striking difference between sulphate of nicotine and akar tuba, the latter being far superior in its killing effect. It is presumed that the cause lies in the rapid evaporation of the sulphate of nicotine. Addition of soap did not show any effect on the aphicidal qualities."

Experiments with *Prodenia litura* F. show that akar tuba spray is not effective. Syrphid flies are also resistant.

The literature is reviewed, and 51 references to articles are given. Four figures show photographs of *Derris elliptica,* its flowers, and leaves.

Kurz, S. (235)

FOREST FLORA OF BRITISH BURMA. 549 p. Calcutta. 1877.

Describes seven species of derris, including *uliginosa* and *elliptica* found in British Burma (p. 338–341).

LaForge, F. B. (236)

ROTENONE. IV. CONSTITUTION OF ROTENONE. Jour. Amer. Chem. Soc. 52: 1102–1104. 1930.

The typical reactions of rotenone are explained by a formula based on Takei's theory of the structures of rotenic, tubaic, and dihydrotubaic acids, together with the composition and properties of derric acid. The rotenone molecule is shown to consist of two parts joined together by a lactone and a ketone linkage. Tubaic acid is formed from one part, derric acid from the other.

——— and Smith, L. E. (237)

ROTENONE. I. REDUCTION PRODUCTS OF ROTENONE. Jour. Amer. Chem. Soc. 51: 2574–2581. 1929.

The empirical formula for rotenone, $C_{23}H_{22}O_6$, proposed by Butenandt (*64*) and Takei (*388*) has been confirmed.

As a result of many experiments with a variety of solvents, and with platinum as well as palladium catalysts, the authors have always obtained a mixture of two substances if the process is stopped after the absorption of about two molecules of hydrogen. These substances are easily separated from each other, since one is an acid and the other a neutral compound. The combined quantities of these products are about equal to the quantity of rotenone employed and occur in about equal proportions if platinum is used, but with palladium the neutral compound predominates. Both compounds have the same empirical formula, $C_{23}H_{24}O_6$. The acid melts at 209° and the neutral compound at 164°. The neutral compound is dihydrorotenone. On further long-continued hydrogenation, dihydrorotenone is converted in part to an acid, $C_{23}H_{26}O_6$. The same acid is more easily obtained from the original acid by further reduction. The new acid melts at 215°.

Butenandt has prepared a compound called derritol by reducing rotenone in alcoholic potassium hydroxide solution with zinc. This derivative is a phenol containing two carbon atoms less than rotenone. He states that an analogous compound could not be obtained from his dihydrorotenone. The authors have found that dihydroderritol is easily obtained by this reaction from dihydrorotenone.

Takei obtained isorotenone by the action of strong acids on rotenone. This compound does not take up hydrogen as does rotenone and probably contains a ring instead of a double bond. On reduction with zinc in alcoholic potassium hydroxide solution it gives isoderritol and isorotenol.

——— and Smith, L. E. (238)

ROTENONE. II. THE DERIVATIVES OF DERRITOL. Jour. Amer. Chem. Soc. 52: 1088–1091. 1930.

Both derritol and rotenol give mixtures of neutral and acid products on catalytic hydrogenation. In the case of derritol, which is itself a phenolic compound, it was necessary to methylate the phenol group for convenience in separating the acid.

LAFORGE, F. B., and SMITH, L. E.—Continued.

Dihydromethylderritol and methylderritolic acid were the products of the reduction. Rotenol gave dihydrorotenol and rotenolic acid. The latter was further reduced to dihydrorotenolic acid. These results indicate that the atomic groupings which form derritol from rotenone are not the same as those involved in the formation of acids from rotenone and many of its derivatives.

——— and SMITH, L. E. (239)

ROTENONE. III. DEHYDROROTENONE. Jour. Amer. Chem. Soc. 52: 1091–1098. 1930.

Dehydrorotenone and the corresponding compounds of the dehydro series are best prepared by the action of iodine and potassium acetate on rotenone and its derivatives. A portion of the dehydrorotenone derivative is obtained directly, but the main product of the reaction is an acetyl derivative of a compound $C_{23}H_{22}O_7$ (in the case of rotenone itself), which yields a hydroxyl derivative on saponification. This compound loses water on boiling with alcoholic sulphuric acid and is converted into dehydrorotenone. Rotenonone and other diketones prepared by oxidation from rotenone, etc., are derivatives of the dehydro series. Rotenolone, the hydroxy derivative of rotenone, yields derritol and rotenol on treatment with zinc in alkaline solution. Dehydrodihydroxyrotenonic acid, $C_{23}H_{24}O_8$, prepared from dehydrorotenone by the action of zinc and alkali or alkali alone, according to the directions of Butenandt, was oxidized with hydrogen peroxide in alkaline solution, and yielded a dibasic acid, $C_{12}H_{14}O_7$, which represents that half of the rotenone molecule which carries the original methoxyl groups as well as the carboxyl that in rotenone is coupled with the other half of the molecule to form the lactone group. The second carboxyl is formed by oxidation of the original carbonyl group. The dibasic acid has been called derric acid.

——— and SMITH, L. E. (240)

ROTENONE. VI. DERRIC ACID. Jour. Amer. Chem. Soc. 52: 2878–2881. 1930.

Derric acid of formula $C_{12}H_{14}O_7$, which is obtained by peroxide oxidation of dehydrodihydroxyrotenonic acid of formula $C_{23}H_{24}O_8$, is oxidized by permanganate to a new dibasic acid of formula $C_{11}H_{12}O_7$ having the properties of a dimethoxytartronic acid. It seems likely that the rotenone molecule contains the grouping corresponding to a dimethoxyphenylsuccinic acid. Such an assumption might explain the formation and properties of dehydrorotenone. A possible explanation of the formation of dehydrodihydroxyrotenonic acid by the addition of the elements of water to the double bond is open to theoretical objections.

——— and SMITH, L. E. (241)

ROTENONE. VIII. ISOMERIC HYDROXY ACIDS AND THEIR RELATION TO DEHYDROROTENONE. Jour. Amer. Chem. Soc. 52: 3603–3609. 1930.

Dehydrodihydrorotenonic acid with potassium hydroxide and zinc in ethyl alcohol gives β-dihydrohydroxyrotenonic acid, $C_{23}H_{26}O_7$, melting point 198° C.: oxidation with 30 per cent hydrogen peroxide in 5 per cent potassium hydroxide gives derric acid. Acetylrotenolone is reduced in ethyl acetate by platinum oxide and hydrogen to acetyl-*a*-dihydrorotenolonic acid (acetyl-*a*-dihydrohydroxyrotenonic acid), melting point 210° to 214° (decomposition), and acetyldihydrorotenolone, melting point 189°. Hydrolysis of the acetyl derivative or direct reduction of rotenolone gives dihydrorotenolonic acid, which could not be recrystallized. The acetyl derivative boiled with 10 per cent ethyl-alcohol-sulphuric acid gives dehydrodihydrorotenonic acid. Oxidation of rotenonic acid with hydrogen peroxide in 5 per cent potassium hydroxide gives dehydrorotenonic acid, yellow, melting point 225°: the methyl alcohol mother liquor gives a hydroxyrotenonic acid, melting point 137°. Catalytic reduction of *a*-hydroxyrotenonic acid gives an isomeric *a*-dihydrohydroxyrotenonic acid, melting point 132°. Boiling the hydroxyrotenonic acid with 10 per cent ethyl alcohol-sulphuric acid gives a compound with a melting point of 275° and dehydrorotenonic acid, melting point 225° to 227°; catalytic reduction of the latter gives dehydrodihydrorotenonic acid, $n\ \alpha 1.470$, $n\ \beta 1.690$, $n\ \gamma 1.737$. Oxidation of this gives an acid, melting point 262° (decomposition), identical with that obtained from derric acid; oxidation of dehydrodihydroxyrotenononic acid gives dihydrotubaic acid, melting point 167°. Boiling dehydrodihydrorotenononic acid in glacial acetic acid for a few minutes gives dihydrorotenonone. Attempts to separate derric acid into its optical isomers were unsuccessful.

LECOMTE, M. H., and GAGNEPAIN, F. (242)

FLORE GÉNÉRALE DE L'INDO-CHINE. T. 2, Fasc. 4, 1132 p., illus. Paris. 1916.

Describes 15 species of Derris, including *D. uliginosa* and *D. elliptica* (p. 447–462).

LEE, F. C. (243)

DERRIS ROOT GROWS WILD IN MALAY ARHIPELAGO. U. S. Dept. Com., Bur. Foreign and Dom. Com., World Trade Notes on Chemicals and Allied Products. 2(36): 16–17. 1928.

Figures given on acreage and prices of derris root are essentially the same as those reported by Southard (*376*). Cutting the roots into small pieces before shipment saves space but results in loss of toxic value.

LEEFMANS, S. (244)

DE KOOLCULTUUR OF DE KARO-HOOGVLAKTE. Landbouw 2: 627–644. 1927.

"The Chinese and Batak cabbage growers have evidently gone over to the use of lead arsenate following the tobacco growers in Deli. Dr. H. Loos, at that time

LEEFMANS, S.—Continued.

Agricultural Consul for Sumatra's East Coast, wrote us Nov. 10, 1925: 'At the moment the Chinese and Batak cabbage growers are using in addition to the usual Derris solution (extract), lead arsenate. They buy it for 70 fluorins per drum of 50 kilogram postpaid Brastagi. They mix about 300 grams with 18 liters water and a handful of Derris root. The practical results have been very satisfactory, and lead arsenate, which a year ago was practically unknown to the cabbage growers, is now suddenly very popular.'

"We can report that a Derris suspension in water against cabbage caterpillars gave unfavorable results. On the other hand, we have obtained excellent results if finely pulverized Derris was extracted with alcohol. The practical conclusion is that addition of a water suspension of Derris or Derris roots to a solution of lead arsenate is wholly useless since the latter, with the addition of soap, is satisfactory."

LENFEST, R. E. (245)

CITRUS COMMENTS. Citrus Indus. 7(4) : 20. 1926.

Derrisol and Black Leaf 40 are mentioned as about the two best contact insecticides for use against citrus aphids. Derrisol spreads well without soap. Lime-sulphur mixed with Derrisol will kill the rust mites and red spiders as well as the aphids.

LENZ, W. (246)

ZUR KENNTNIS DER BESTANDTEILE EINIGER DERRIS-ARTEN. Arch. Pharm. 249: 298–305. 1911.

Successive extractions of Derris (*D. elliptica*) root from New Guinea with various solvents at room temperature gave the following:

Petroleum ether, 2.1 per cent; ether, 8.9 per cent; alcohol, 6.8 per cent; water, 4.8 per cent.

Lenz calls the active principle "derrin." The best procedure by which to get this is to extract the roots with boiling benzol. The benzol is distilled off, and the residue taken up in boiling alcohol. The derrin crystallizes from this. Derrin recrystallized from ether melts at 158° C. The crystals (rhombic plates) are easily soluble in acetone, benzol, and chloroform, and more difficultly soluble in cold alcohol and cold ether.

The crystallographic properties of the crystals are described.

Derrin apparently has a lactone structure.

Derrin tested upon fish (*Rhodeus amarus* Bl.) showed a strong toxic action.

The roots of *D. stuhlmannii* from German East Africa were also examined. Successive extractions gave: Petroleum ether, 3 per cent; ether, 5 per cent; alcohol, 2 per cent; water, 10.2 per cent. The constituents in these extracts had no similarity to those from *D. elliptica.*

LEWIN, L. (247)

DERRIS ELLIPTICA BENTH. (PONGAMIA MONTANA BI.) Die Pfeilgifte. 517 p. illus. Leipzig. 1923.

The author gives native names of *Derris elliptica* (p. 88–89). In Sumatra the diluted root sap is used to kill caterpillars on young tobacco plants, but too great a quantity kills the tobacco. The root of derris in commercial form is pictured. Men who have drunk water treated with derris to poison fish are made ill and may collapse and die. Derris is an ingredient of arrow poisons (p. 116–121, 130–137, 146–153, 181).

LIGHT, S. S. (248)

NEWLY-RECORDED FOOD PLANTS OF SOME PESTS OF TEA AND GREEN MANURES. Tea Quart., Jour. Tea Research Inst. Ceylon 1 (pt. 3) 77–79. 1928.

Shot-hole borer attacking the green manure plant, *Derris robusta,* forms another new record. This outbreak was reported in July, 1927, on an estate in Uva, where the derris plants had evidently become infected from tea, which already contained the borer.

LINNE, C. von. (249)

FLORA ZEYLANICA. No. 417, 240 p., illus. Holmiae. 1747.

Derris uliginosa is described but referred to the genus Pterocarpus (p. 196).

——— (250)

SPECIES PLANTARIUM. Ed. 4, v. 3 (pt. 2), p. 851–1474. Berolini. 1801.

A botanical description of *Robinia uliginosa* (*Derris uliginosa*) from Eastern India is given (p. 1133–1135).

LIPP, J. W. (251)

PRELIMINARY TESTS WITH POSSIBLE REPELLENTS OF THE ORIENTAL PEACH MOTH. Jour. Econ. Ent. 22: 116–126. 1929.

Derris compound, 1 to 500, seemed to have no repellent action against the oriental peach moth (*Laspeyresia molesta* Busck).

Little, R. L. (252)

DISEASES OF THE NUTMEG TREE. Jour. Indian Archipelago and Eastern Asia (Singapore) 3: 678–681. 1849.

The branches and stem of a diseased nutmeg tree were scrubbed and washed with an infusion of the tuba root in which was mixed certain quantities of sulphur and Bengal soap. It had no effect.

Livingstone, D. (253)

MISSIONARY TRAVELS AND RESEARCHES IN SOUTH AFRICA. 732 p., illus. New York. 1858.

Derris uliginosa is reported as growing on the Luabo River, eastern Africa.

Loureiro, J. de. (254)

FLORA COCHINCHINENSIS, SISTENS PLANTAS IN REGNO COCHINCHINA NASCENTES; QUIBUS ACCEDUNT ALIAE OBSERVATAE IN SINENSI IMPERIO, AFRICA ORIENTALI, INDIAEQUE LOCIS VARIIS; OMNES DISPOSITAE SECUNDUM SYSTEMA SEXUALE LINNAEANUM. v. 1, 882 p. Berolini. 1793.

Derris pinnata and *D. trifoliata* from Cochin China, are described (p. 525–526).

Lyons, A. B. (255)

PLANT NAMES, SCIENTIFIC AND POPULAR. Ed. 2, thoroughly rev., 630 p. Detroit. 1907.

The synonomy of Derris Lour. 1790 (Papilionaciae) is given as follows: Syn. Pterocarpus. L. 1747, not 1763 (O. Kze.), Salken, Adans. 1763, Deguelia, Aubl. 1775; Pongamia, in part.

D. elliptica Benth. An ingredient in the Malay Ipoh arrow poison is used also as fish poison, as is (*b*) *D. uliginosa* Benth. (Pongamia uliginosa DC., Pong. religiosa Wight), which is widely diffused on tropical coasts (p. 162).

In Brazil *Serjania lethalis* A. St. Hil. is used as a fish poison under the name of timbo. Honey collected by wasps from the flowers is violently intoxicating (p. 426).

McBride, O. C. (256)

A STUDY OF DERRIS AND RELATED INSECTICIDES FOR THE CONTROL OF EXTERNAL PARASITES OF DOMESTICATED ANIMALS. Minn. Agr. Expt. Sta. Ann. Rpt. 33 : 37. 1925.

This is one of the projects listed under Entomology and Economic Zoology.

——— (257)

A LEAFHOPPER (EUPTERYX FLAVOSCUTA, VAR. NIGRA. OSB.) ATTACKING THE LEATHER-LEAF FERN (POLYSTICHUM CAPENSE J. SM.). Fla. State Hort. Soc. Proc. 39: 224–227. 1926.

Tests were made with nicotine, lime dust, nicotine sulphate, calcium cyanide, and derris.

Five per cent of derris, 1–800 and 1–600, plus soap, 2 pounds to 50 gallons, gave satisfactory control, but was slow in its effective work. The fernery was free from leaf hoppers for 13 days after the spraying with derris. The reinfestation occurred from eggs deposited before the application of the spray.

A second application of nicotine sulphate gave 75 to 80 per cent control, whereas 5 per cent extract of derris gave 98 to 99 per cent. A small amount of injury was observed on all the sprayed plots. It was thought to be a mechanical injury and not considered of any commercial importance.

McDaniel, E. I. (258)

LEAF-HOPPERS AND APHIDS EASILY CONTROLLED. Mich. Agr. Expt. Sta. Quart. Bul. 10: 171–172. 1928.

Among the other better known contact sprays are Derrisol and some of the pyrethrum extracts. With these, as with nicotine, each insect must be hit to be killed.

McDougall, I., and Howles, F. (259)

IMPROVEMENTS IN THE MANUFACTURE OF INSECTICIDES, SHEEP DIPS, VERMIFUGES, AND THE LIKE. Australian Patent 18227, issued November 18, 1924; applied for June 16, 1924.

The same as British Patent 226250 (*260*).

——— and Howles, F. (260)

IMPROVEMENTS IN THE MANUFACTURE OF INSECTICIDES, SHEEP DIPS, VERMIFUGES AND THE LIKE. Brit. Patent 226250, issued December 23, 1924; applied for June 23, 1923.

The patentees claim a process for the production of an insecticide, sheep dip, vermifuge, or the like which is directly miscible with water. In this process the root portion of the plants, bushes, or trees of the Dalbergia tribe and Derris family are crushed or pressed to a pulp, and the fibrous particles are scoured by mechanical means in the presence of a suitable aqueous solution of soap or other body which on solution will lower the surface tension of water. Finally the fibrous material

McDougall, I., and Howles, F.—Continued.

is separated from the magma. The active ingredients may be separated from the latex by precipitation with a basic salt of aluminum, iron, or lead. For example, to 100 cubic centimeters of the latex, a quantity of concentrated aluminum sulphate solution is added, so that the final dilution of the aluminum sulphate in the latex is equivalent to 0.2 per cent. To this is added a solution of caustic soda in quantity insufficient to precipitate the whole of the aluminum sulphate as hydroxide.

——— and Howles, F. (261)

INSECTICIDE, SHEEP DIP, VERMIFUGE, ETC. Canadian Patent 247627, issued March 17, 1925; applied for May 22, 1924.

The same as British Patent 226250 (*260*).

——— and Howles, F. (262)

IMPROVEMENTS RELATING TO INSECTICIDES. Brit. Patent 233857, issued May 21, 1925; applied for April 15, 1924.

The patentees claim, in insecticides, the combination comprising a mixture of nicotine with derris extract or powdered derris plant and a neutral inert body, such as precipitated calcium carbonate or calcium sulphate. Another example of preparing this insecticide is: 2 parts by weight of nicotine are mixed with 5 parts by weight of powdered root and 93 parts of precipitated calcium carbonate. The extract may be obtained by the process described in prior specifications Nos. 3204 of 1911, 10215 of 1911, and No. 8322 of 1912, or in specification No. 226250 (*260*).

——— and Howles, F. (263)

PERFECTIONNEMENTS DANS LA FABRICATION D'INSECTICIDES, DE BAINS POUR MOUTONS, DE VERMIFUGES ET DE PRÉPARATIONS SIMILAIRES. French Patent 589969, issued June 9, 1925; applied for May 14, 1924.

The same as British Patent 226250 (*260*).

McDougall, I. S., McDougall, I., and McDougall, S. (264)

IMPROVEMENTS RELATING TO INSECTICIDES, SHEEP DIP, VERMIFUGES, AND THE LIKE. Brit. Patent 3204 of 1911, issued May 8, 1912; applied for February 8, 1911.

The patentees claim in the manufacture of insecticides, sheep dips, animal washes, vermifuges, and the like, the use of an organic salt or salts, compound or compounds obtained from the plants, bushes, or trees known as tuba rabut, tuba tedong, acre (or akar) tuba, and perkakal. The powdered bark, root, or other portions of the plant are extracted by a suitable solvent, such as benzine, the excess of solvent is evaporated, and the gummy residue is then mixed with the necessary ingredients for producing the required dip, wash, insecticide, or vermifuge, or it may be crystallized before such use. During the manufacture of the dip, etc., a suitable water-softening reagent or a suitable antiseptic, bactericide, or coloring matter may be added. In practice the mixture employed will contain from 1 ounce of the compound to 100 imperial gallons of water for the destruction of small and delicate insects, up to 12 ounces of the compound to 100 imperial gallons of water for the destruction of the more hardy and vigorous caterpillars. A suitable apparatus for the extraction is described.

——— McDougall, I., and McDougall, S. (265)

IMPROVEMENTS RELATING TO INSECTICIDES, SHEEP DIPS, VERMIFUGES, AND THE LIKE. Brit. Patent 10215 of 1911, issued May 28, 1912; applied for April 27, 1911.

The patentees claim in the manufacture of sheep dips, animal washes, vermifuges, and insecticides, the use of an organic salt or salts, compound or compounds obtained from the plants, bushes, or trees of the family known botanically as Derris of the order of Leguminosae, as set forth. This invention is an improvement over that described in British Patent 3204 of 1911 (*264*).

——— McDougall, I., and McDougall, S. (266)

IMPROVEMENTS RELATING TO INSECTICIDES, SHEEP DIP, VERMIFUGES AND THE LIKE. Brit. Patent 8322 of 1912, issued December 19, 1912; applied for April 6, 1912.

The patentees claim improved insecticides, sheep dips, vermifuges, and the like. comprising, in a powdered or finely divided form, the root, bark, or other portions of the plants, bushes, or trees of the Dalbergie tribe and Derris family and of perkakal, from which an organic salt or salts, compound or compounds is extractable by moisture or water. This invention is an improvement over that described in the patentees' prior specifications—Brit. Patents 3204 of 1911 (*264*), and 10215 of 1911 (*265*). The ground derris root may be mixed with soap, sulphur, or other substances.

——— McDougall, I., and McDougall, S. (267)

INSECTICIDE, SHEEP-DIP, VERMIFUGE, ETC. U. S. Patent 1065156, issued June 17, 1913; applied for September 8, 1911.

The patentees claim a composition for use as an ingredient for animal washes, insecticides, and vermifuges, comprising a concentrated extract of trees of the

McDOUGALL, I., and McDOUGALL, S.—Continued.

Derris family, which gives a red color when treated with concentrated sulphuric and nitric acids and a fugitive brilliant green color on the further addition of concentrated ammonia solution, and carrying and emulsifying agents. The powdered dried roots are extracted with a suitable solvent, such as benzine, and the extract is evaporated to a gummy mass. For a sheep dip a mixture of 5 ounces of the compound and 1 pound of soft soap may be used, such mixture being adapted for use with 100 imperial gallons of water; or 5 ounces of the compound may be mixed with 15 ounces of soft soap, the mixture being then absorbed into a powder by means of sulphur to make a total weight of 10 pounds. This preparation should be used with 100 imperial gallons of water. During the manufacture of the dip, wash, or insecticide a suitable water-softening reagent or reagents may be added to the composition. In like manner a suitable antiseptic or bactericide and also a coloring matter may be added.

McDOUGALL and YALDING (LTD.) (268)

INSECTICIDE, SHEEP DIPS AND THE LIKE. Canadian Patent 253319, issued September 1, 1925; applied for November 26, 1924.

The same as British Patent 229773 (*270*).

——— (269)

PERFECTIONNEMENTS AUX INSECTICIDES, AUX BAINS POUR MOUTONS ET AUX SUBSTANCES SIMILAIRES. French Patent 589506, issued May 30, 1925; applied for November 22, 1924.

The same as British Patent 229773 (*270*).

——— and FRYER, P. J. (270)

IMPROVEMENTS IN INSECTICIDES, SHEEP DIPS, AND THE LIKE. Brit. Patent 229773, issued March 2, 1925; applied for December 1, 1923.

The patentees claim insecticides, sheep dips, animal washes, and the like, comprising an organic salt or salts, compound or compounds obtained from the root, bark, or other portions of the plants, bushes, or trees of the Dalbergie tribe and Derris family and/or of perkakal, and sulphonated castor oil as a vehicle or spreading or activating agent for such organic salt or salts, compound or compounds.

In this invention improved insecticides, sheep dips, and the like may be formed from, or so as to contain, an organic salt or salts, compound or compounds obtained from the root, bark, or other portions of the plants, bushes, or trees of the Dalbergiae tribe and Derris family and of perkakal in the manner described, for example, in the specifications of British patents Nos. 3204 of 1911, 10215 of 1911, and 8322 of 1912, but in place of mixing with soap or soapy material sulphonated castor oil (known as Turkey red oil and soluble oil) is employed as the vehicle or spreading or activating agent. For the best results the sulphonation of the castor oil should be conducted at a low temperature (not exceeding 40° C.) and by the use of acid which is of not too concentrated a form (for example, 94 per cent strength) and free mineral acid must be removed from the sulphonated product by suitable treatment.

——— and FRYER, P. J. (271)

IMPROVEMENTS IN INSECTICIDES, SHEEP DIPS, AND THE LIKE. Brit. Patent 246252, issued January 28, 1926; applied for November 12, 1924.

The patentees claim an improvement in, or modification of the invention claimed in specification No. 229773, according to which the sulphonated castor oil is replaced by any other sulphonated fatty oil, sulphonated sperm oil, or a sulphonated wax. The most satisfactory results are obtained by extracting derris with benzene or other suitable volatile solvent, and after the solvent has been distilled off, by dissolving the residue by the aid of gentle heat in the sulphonated oil or wax. The best proportion is 1 part of derris extract to 10 to 50 parts of the sulphonated oil or wax. This mixture may be used with lead arsenate and Bordeaux mixture, but for use with lime-sulphur solution it is necessary to add from 5 to 20 per cent of casein to prevent precipitation.

——— and FRYER, P. J. (272)

IMPROVEMENTS IN INSECTICIDES, SHEEP DIPS AND THE LIKE. Brit. Patent 280256, issued November 17, 1927; applied for November 24, 1926.

The patentees claim a process for producing concentrated, complete, and self-contained insecticides containing physiologically active, substantially water-insoluble plant extracts, extracted from plants mainly of the order of Leguminosae (particularly those containing tubatoxin (rotenone) and/or tephrosin). The process consists in dissolving such extracts in a phenolic body or suitable solvent, adding the solution to a hydrocarbon oil or mixture of hydrocarbon oils, and finally emulsifying the whole. The emulsion needs only simple admixture with water in suitable proportions to form a spraying solution. The extraction of such suitable active plant material has been described in British patent 3204 of 1911. According to one example, 1 part of the resinous active principle from derris or other source is dissolved by warming it with 2½ parts of commercial cresylic acid. This is now added to 288 parts of a suitable hydrocarbon oil—for example, medium lubricating-oil fraction of American petroleum—and after the addition of 100 parts of a 10 per cent glue solution the whole is emulsified. According to a second example, the

McDougall and Yalding (Ltd.), and Fryer, P. J.—Continued.

solution of the active principle in cresylic acid, as described in the first example, is added to 288 parts of suitable hydrocarbon oil, and the whole is mixed with 12 parts of ammonium oleate or linoleate to form a homogeneous solution, which is diluted with water.

MacDougall, R. S. (273)

INSECTS AND OTHER PESTS OF 1923. Highland and Agr. Soc. Scot. Trans. (5) 36: 100–140. 1924.

Ian Galloway reported that no injurious effects attended any of the cattle dressed with derris for warble infestation and there was no discomfort to the hands of the dresser. Special care was taken—large holes being used—to insure entry of the liquid to the warble. A proprietary preparation of derris was used in two strengths—1 ounce to a quart of water and 1 ounce to a pint of water. With 1 ounce of the derris preparation in 1 imperial quart of water, 440 warbles were treated and 378 larvae killed—that is, 86 per cent of the treated larvae were killed. With 1 ounce of the derris preparation in 1 imperial pint of water 614 warbles were treated and 581 larvae were killed—that is, 94 per cent of the treated larvae were killed (p. 125).

——— (274)

OX WARBLE FLIES. Scot. Jour. Agr. 7: 61–72. 1924.

"In spring and summer we used a proprietary preparation of derris. In testing this material the powder was used in the strength of 1 ounce to 1 imperial quart of water and 1 ounce to a pint of water. This dressing had a very fair test, the main work, under my supervision, being carried out by Mr. Galloway in Berwickshire, East Lothian, and Midlothian. Mr. Galloway's work was very thorough, more careful than that of the average worker would be in ordinary farm practice. Any scab and matted hair obscuring the exit hole of the larva in the skin was cleared away before applying the dressing. Further, a stout syringe was generally used, insuring the entry of the liquid. I was able here to take advantage of Mr. Galloway's skill as a veterinary surgeon, for pulse, respiration, and temperature were taken before and after dressing, and any consequent symptoms were recorded. No injurious effect attended any of the cattle dressed with derris, and the derris dressing proved destructive to *Hypoderma* larvae. No difficulty was found in applying the dressing, and there was no discomfort to the hands or face of the dresser in case of shaking of the liquid. Mr. Oldham, in some cases which he dressed with derris, found that, unless care was taken to insure a thorough mixing of the derris powder in the water, the nozzle of the syringe became clogged with powder taken up from the bottom of the receptacle in recharging the syringe."

One ounce of derris to 1 imperial quart of water killed 86 per cent, and 1 ounce to 1 pint killed 94 per cent of the warbles (p. 65–70).

McIndoo, N. E., and Sievers, A. F. (275)

PLANTS TESTED FOR OR REPORTED TO POSSESS INSECTICIDAL PROPERTIES. U. S. Dept. Agr. Bul. 1201, 61 p. 1924.

Derris elliptica and *D. uliginosa* are included in the list of plants having insecticidal properties. The following results were obtained by using a commercial powder consisting of a mixture of *D. elliptica* and *D. uliginosa.* The powder, used as a dust, was effective against three species of aphids (*Aphis* sp. A and B, and *Macrosiphonella sanborni*), and silkworms, but killed only about half the *Macrosiphum* sp. A treated within 24 hours. Used as a decoction (not filtered) and also as a hot-water extract (filtered), it was efficient against *Aphis* sp. A and B, and used as a fumigant it was efficient against *Myzus persicae, Macrosiphum* sp. C, silkworms, and the lady beetle treated, but inefficient against webworms and small tent caterpillars. The alcoholic and benzene extracts of derris, when sufficiently strong and used with soap or kerosene emulsion, were found efficient against many species of aphids. The alcoholic extract, used with soap, was efficient against half-grown sawfly larvae, but inefficient against small webworms (first instar) and the larvae and adults of potato beetles. At Tallulah, La., a commercial preparation of powdered derris, used on three dogs which were infested with fleas (*Ctenocephalus canis* Curt.), was found efficient against the fleas.

———, Sievers, A. F., and Abbott, W. S. (276)

DERRIS AS AN INSECTICIDE. Jour. Agr. Research 17: 177–200. 1919.

The following is a list of the materials used in the tests and the sources from which and through which each was secured: Powdered roots of a derris species, most likely *Derris elliptica,* from the open market, where it is sold as an insecticide; roots of *D. elliptica,* called tuba or toeba in the Dutch East Indies, from the 's Lands Plantentuin, Buitenzorg, Java; stems of *D. uliginosa* from C. H. Knowles, Suava, Fiji Islands; stems of *D. koolgibberah* and of *D. oligosperma,* from the director of the botanical gardens at Brisbane, Queensland, Australia; roots of *D. scandens;* and stems and roots of *D. robusta,* from the director of the botanical survey of Sibpur, Calcutta, India.

Derris acts both as a contact insecticide and as a stomach poison, but is of no practical value as a fumigant. Of the six species of derris tested, only two (*elliptica* and *uliginosa*) were found to be satisfactory for insecticidal purposes.

Denatured alcohol was found to be a good economic solvent for extracting the toxic principle, which when applied in spray mixtures proved to be efficient against certain aphids, potato-beetle larvae, and small fall webworms. For proprietary insecticides it is possible to incorporate the extracts from derris into soft soaps which when greatly diluted with water are ready for use.

Derris powder used as a dust under practical conditions was found to be efficient against dog fleas, chicken lice, house flies, three species of aphids (*Aphis rumicis* L., McINDOO, N. E., SIEVERS, A. F., and ABBOTT, W. S.—Continued.

Aphis pomi De Geer, and *Myzus persicae* Sulz.), potato-beetle larvae, and small fall webworms, but of no practical value against bedbugs, roaches, chicken mites, mealybugs, *Orthezia insignis*, red spiders, or against the crawling young of the oyster-shell scale. Used as powder in water with or without soap under practical conditions, it proved to be efficient against most of the aphids sprayed and also against cabbage worms (*Autographa brassicae* Riley), the larvae of apple datanas (*Datana ministra* Dru.), oak worms (*Anisota senatoria* S. and A.), small tent caterpillars, and potato-beetle larvae.

McKEE, E. (277)

THE CULTIVATION OF DERRIS (TUBA ROOT) IN BRITISH MALAYA. U. S. Dept. Com., Bur. Foreign and Dom. Com. Spec. Circ. 151. 1926.

States that increased attention has been given to the cultivation of derris (tuba root) in British Malaya within the past few years. This product, commonly known as derris or tuba root, is locally termed rimba and tuba merah. Just exactly what rimba and tuba merah mean botanically is uncertain, but the terms are recognized in the local markets as indicating a difference in the toxic contents of the varieties.

Derris or tuba is the essential property in several proprietary insecticides. This root is coming into greater demand. The most popular commercial need is probably in cattle dips and fruit sprays. The Malay natives employ it as a poison for fish and animals.

The Malay Archipelago is considered as a factor in the world's supply of derris (tuba root), Borneo probably supplying the greatest quantity. At the beginning of 1925 there were 500 acres under this form of cultivation in the four Federated Malay States, 600 acres in the State of Johore, an independent State at the southern end of the Malay Peninsula, and probably a larger acreage in Borneo and other territories.

In the local market there is considerable fluctuation in the price of tuba root. The estate owners will, as far as possible, demand a price near 1 shilling per pound, 24 cents United States currency, for the cultivated product, whereas buyers in Singapore can purchase considerable quantities from the native collectors and small cultivators at from 5 to 6 pence per pound (10 to 12 cents United States currency). The ruling price is usually dependent upon the immediate supply of the two sources.

The two principal difficulties experienced by the local shippers in marketing tuba root are the lack of knowledge as to its toxic value and the excessive bulk which causes high freight charges. Attempts have been made to extract the toxic properties before shipping, but they have not proved satisfactory. Chopping up the root reduces its bulk to some extent, but grinding the root, then pressing it into bales, is probably the most common method. This method is followed by two factories in Malaya.

Great Britain is probably Malaya's chief purchaser of derris root. Considerable quantities are now being shipped to Australia, where it is said to be coming into increased demand through the popularity of a certain sheep dip containing tuba. Quantities are also shipped to Nova Scotia.

MAHEU, J. (278)

LES TOUBA PARASITICIDES. (*Derris elliptica* Benth. et *Derris uliginosa* Benth., Légumineuses). Bul. Sci. Pharmacol. 32 (3) : 134–145; (5) : 281–292. 1925.

A brief review of the chemical constituents and use as insecticides of *Derris elliptica* and *D. uliginosa*. The histology of the roots of both species is given in great detail, with numerous figures.

MAIDEN, J. H. (279)

THE USEFUL NATIVE PLANTS OF AUSTRALIA (INCLUDING TASMANIA). 696 p., London and Sydney. 1899.

Derris uliginosa occurs in Queensland and Northern Australia. The leaves are pounded and thrown into water for the purpose of stupefying fish (p. 168).

MARLATT, C. L. (280)

REPORT OF THE ENTOMOLOGIST. U. S. Dept. Agr., Bur. Ent. Ann. Rpt. 1928, 34 p.

"Materials tested as contact sprays and ovicides [against the codling moth] included nicotine oleate and nicotine sulphate at different strengths, extracts of derris 1 to 800, extracts of pyrethrum, and white-oil emulsions" (p. 2).

——— (281)

REPORT OF THE CHIEF OF THE BUREAU OF ENTOMOLOGY. U. S. Dept. Agr., Bur. Ent. Ann. Rpt. 1929, 39 p.

In the spring of 1929 experiments were started to determine the value as a spray of oil in combination with nicotine, pyrethrum, derris, and also with nicotine combined with various other materials. The most active principle of derris, rotenone, was tested. The so-called sandwich method for determining the minimum lethal doses of dried powdered stomach-poison insecticides was used to determine the absolute toxicity of a number of stomach poisons, including rotenone.

Further experimental work was done with insecticides applied to the backs of cattle, special attention being given to tobacco powders of high nicotine content and dusts containing nicotine sulphate, free nicotine, and rotenone and other materials ex-

MARLATT, C. L.—Continued.

tracted from derris root. These insecticides show high toxicity for cattle grubs and can undoubtedly be developed to a point where they can be extensively used in control procedure (p. 2–3, 27).

——— (282)

REPORT OF THE CHIEF OF THE BUREAU OF ENTOMOLOGY. U. S. Dept. Agr., Bur. Ent. Ann. Rpt. 1930, 76 p.

Derris extract combined with white-oil emulsion has been tested in the field against codling moths at Yakima, Wash.; Bentonville, Ark.; and Wichita, Kans. Field and laboratory tests have been made with rotenone (p. 18). The work of Back, Cotton and Roark (26) in moth-proofing woolens with an acetone solution of rotenone is mentioned (p. 60). For the control of cattle grubs (Hypoderma larvae) 2 or more ounces of derris powder per animal is necessary if the entire back of the animal is to be treated (p. 64).

MARSDEN, W. (283)

THE HISTORY OF SUMATRA, CONTAINING AN ACCOUNT OF THE GOVERNMENT, LAWS, CUSTOMS, AND MANNERS OF THE NATIVE INHABITANTS, WITH A DESCRIPTION OF THE NATURAL PRODUCTIONS, AND A RELATION OF THE ANCIENT POLITICAL STATE OF THAT ISLAND. Ed. 3, 478 p., illus. London. 1811.

Besides the common methods of taking fish, the natives employ a mode unpracticed in any part of Europe. They steep the root of a certain climbing plant, called tuba, of strong narcotic qualities, in the water where the fish are, producing such an effect that the fish become intoxicated and appear dead, float on the surface of the water, and are taken with the hand. This is generally done in the basins of water formed by the ledges of coral rock, which, having no outlet, are left full when the tide has ebbed (p. 186).

MARTIN, R. (284)

DIE INLANDSSTÄMME DER MALAYISCHEN HALBINSEL. 1,052 p., illus. Jena. 1905.

Mentions use of tuba roots (*Derris elliptica*) in fishing in the Malayan Peninsula (p. 792).

MATHIEU, E. (285)

TUBA-ROOT (DERRIS ELLIPTICA) AS AN INSECTICIDE. Gard. Bul. Straits Settlements 2 (6): 192–197. 1920.

"*Agromyza phaseoli*, a fly, deposits its eggs under the skin of the stem of beans a very few days after germination of the seeds; the larvae feed on the tender tissues of the stems just below the first pair of leaves. The skin, a week or so after germination, turns from green to brown and on pressing with the fingers, it is found to be hollow. The leaves fade and drop, and on splitting open the little stem, the small yellow larvae are found imbedded in the destroyed tissue.

"A trial of tuba was made on a field of 8 beds, 66 feet long, with 1,056 seeds of Lima Bean (Small Siéva) on the 28th of October, 1919. Ten ounces of tuba-root were well pounded in a wooden mortar, the juice was thoroughly expressed, and the fiber exhausted in 20 imperial gallons of water. Tuba-water was then applied to each young plant at the rate of a cigarette tin full to 4 plants, morning and evening. This was continued for 15 days, until the plants were sufficiently established to be past all danger, which is only present during the first stage of their existence, when the stem is quite tender. Only 16 seeds failed to germinate, and of the 1,040 plants that came up, not one has since died. And to-day the plot is showing the most vigorous growth, a living testimony to the potency of the tuba-root as a plant-insect killer."

MAXWELL, G. (286)

IN MALAY FORESTS. 306 p. Edinburgh and London. 1907.

A detailed account of the use of tuba root in catching fish is given. By keeping to the surface of the water small fish escape the tuba, which follows the bottom of the river (p. 246–264).

MAYNARD, L. (287)

DERRIS ROOT SALES IN MALAYA. U. S. Dept. Com., Bur. of Foreign and Dom. Com., World Trade Notes on Chemicals and Allied Products 5 (1): 10. 1931.

The supply of derris received at Singapore is rather irregular. Derris grows in a wild state in Borneo, but it is understood that practically all the supply from that source is contracted for in London. There are about 500 acres under cultivation in the Federated Malay States and 600 acres under cultivation in Johore, one of the unfederated Malay States.

The price of derris is variable, but is usually rather high, owing to a good demand and a limited supply. Native sellers have received as much as from $0.24 to $0.30 per pound for the untreated roots, but Singapore buyers can generally purchase the product at a lower figure, ranging from $0.10 to $0.12 per pound.

The roots are usually shipped in the rough form, although exporters are seeking some method to reduce bulk shipments without lowering the toxic qualities of the roots. Cutting them into small pieces has been tried, but the resulting loss in toxic value makes this method of shipment unsatisfactory. Thus far no suitable means have been found for extracting the poison from the roots before shipment.

MEER MOHR, J. C., VAN DER. (288)
EENIGEN WENKEN VOOR DE BESTRIJDING VAN DE BLADLUIZENPLAAG (MYZUS PERSICAE) IN DE DELI-TABAK. [Some Hints on Work against *M. persicae* on Tobacco in Deli.] Deli-Proefsta. Medan Vlugschr. no. 42, 7 p., illus. 1927. [Abstract in Rev. Appl. Ent. (A) 16:165, 1928.]

Myzus persicae Sulz. is a serious pest of tobacco in Deli, Sumatra. The seed beds are infested from the adjacent forests, and the young plants in the field are either infested in the same way or by the introduction of infested seedlings from the beds. If the beds are very badly infested, the seedlings should be destroyed or dipped in derris solution, experiments having shown that this does not harm them. In the plantations a daily watch should be kept for the first traces of infestation. Spraying with a solution of derris is advised. The application must be repeated after four to five days.

MERRILL, E. D. (289)
A FLORA OF MANILA. 490 p. Manila. 1912.

Describes three species of Derris which grow in the Philippines, namely *D. diadelpha; D. scandens,* and *D. trifoliata* (*uliginosa*) (p. 247–248).

——— (290)
ANNUAL REPORT OF THE DIRECTOR. Calif. Agr. Expt. Sta. Ann. Rpt. 1924–25, 78 p. 1926.

A comparative study of the insecticidal properties of various species of Derris was made to determine the possibility of including species other than that of *D. elliptica* as a source of commercial insecticides. The work included tests of powders made from stem, stalk, and roots of the different species, together with ether, alcohol, and water extracts of them.

The species are listed in the order of efficiency as follows: *D. elliptica; D. polyantha,* and *D. trifoliata.* The percentage of the active principle as extracted by ether was: *D. elliptica,* roots, 1.85 per cent, trunk, 2.26 per cent; *D. heptaphylla,* roots, 4.2 per cent; *D. polyantha,* roots, 3.16 per cent, trunk, 2.95 per cent; *D. trifoliata,* roots, 2.31 per cent, trunk, 3.25 per cent (p. 53).

MILES, H. W. (291)
LIFE HISTORY AND CONTROL OF THE PEA MOTH, LASPEYRESIA NIGRICANA STEPH. Bul. Chamber Hort. 3 (pt. 1): 6–9. 1926. [Abstract in Rev. Appl. Ent. (A) 14:217–218, 1926.]

Cydia (*Laspeyresia*) *nigricana,* Steph. (pea moth) is one of the most serious pests of peas. Experiments were made with various spray substances. In the case of peas grown for marketing green, the best results were obtained by spraying with 2 pounds of calcium caseinate, 2 pounds of lead arsenate powder, and 10 ounces of nicotine per 100 imperial gallons water, applied on July 22 [1926]. The use of this spray resulted in 30 per cent of infested pods and 11 per cent of damaged peas. When the peas grown on the treated plots were threshed they were again examined.

It was found that the lowest percentage of damage (16 per cent) resulted from the use of 20 pounds powdered derris to 100 imperial gallons of water, applied on July 22 [1926]. The use of a spray of 10 ounces nicotine per 100 gallons water with soap sufficient to lather gave almost equally good results. The percentages of damaged peas harvested from plots sprayed with derris or nicotine show little difference from those observed when the green peas were examined. It would seem, therefore, that these sprays have a permanent effect. This contrasts with the results obtained on the plot sprayed with caseinate, lead arsenate, and nicotine, which gave a lower percentage of green peas damaged but a higher percentage of damage to peas harvested when ripe, possibly indicating that this spray has only a temporary influence on the pest.

MILLER, N. C. E. (292)
A MAJOR PEST OF DERRIS; NEOLEPTA BIPLAGIATA. Malayan Agr. Jour. 18: 541–544. 1930.

A small chrysomelid beetle, provisionally identified as *Neolepta biplagiata* Jacoby, is very destructive to derris. Only the adults cause damage by eating the leaves. A mixture of pyrethrum powder, petroleum, fish-oil soap and water, killed 95 per cent of the beetles sprayed with it.

MILLER, R. L. (293)
A CONTRIBUTION TO THE BIOLOGY AND CONTROL OF THE GREEN CITRUS APHID, APHIS SPIRAECOLA PATCH. Fla. Agr. Expt. Sta. Bul. 203. 476 p. 1929.

Derris extract is not toxic to plants when used at any of the ordinary spraying strengths. When used against aphids at 1 part to 800 it gave a 99 per cent kill and at 1 part to 1,000 it gave a 95 per cent kill. This insecticide, however, is a slow-acting material and will not kill all the aphids in 24 hours, but in 36 to 48 hours it shows its real effectiveness. The writer was not able to find that derris extracts had any more lasting effect or repellent action than did nicotine sulphate.

The author concludes that extracts of derris and nicotine sulphate were most successful and gave the most consistent control (p. 467).

Miquel, F. A. W. (294)

FLORA VAN NEDERLANDSCH-INDIË—FLORA INDIAE BATAVAE. v. 1, pt. 1, 1,116 p., illus. Amsterdam, Utrecht, [etc.] 1855.

Gives botanical descriptions of 11 species of derris, including *uliginosa* (p. 140–148).

Moeller, J. and Thoms, H. (295)

DERRID UND DERRIS, REAL-ENZYKLOPADIE DER GESAMTEN PHARMAZIE. Ed. 2, 720 p., illus. Berlin. 1905.

Derrid, the active principle of *Derris elliptica*, is given the formula $C_{33}H_{21}O_7(OCH_3)_3$. This is described as a clear yellow, amorphous, strongly poisonous powder, which melts at about 73° C., is insoluble in water, difficulty soluble in petroleum ether, but easily soluble in alcohol, ether, chloroform, and acetic ether. On heating with alcoholic hydrochloric acid it is converted into anhydroderrid, which occurs in the form of clear yellow needles, that are insoluble in water, difficulty soluble in alcohol, ether, acetic ether, and petroleum ether. The melting point is 214°. Although derrid is a strong fish poison, anhydroderrid is not poisonous to fish (p. 305).

Mootooswamy, P. S. (296)

ON THE MEDICAL PROPERTIES OF SOME OF THE INDIGENOUS PLANTS OF SOUTHERN INDIA. Indian Med. Gaz. 23 (3) : 73–76. 1888.

The woody stem of *Dalbergia uliginosa* Roxb. (*Derris uliginosa* Benth.) is employed in native medicine as a stimulant, antispasmodic, and counterirritant. A medicated oil is prepared from the stem of the creeper with a few other drugs, namely, Lal chithra, plumbago, asafetida, margasae or nim oil, bark of the root of the Montia barloides, and garlic. The oil is highly esteemed by the rural class of people in the southern part of the Tanjore district for its therapeutic action in the treatment of paralysis, chronic rheumatism, dysmenorrhea, and hysterical complaints. It is used in doses of half a dram to a dram twice a day for adults, and 5 to 10 minims for children—low diet. It is also employed as an embrocation externally in these disorders.

Moritzi, A. (297)

SYSTEMATISCHES VERZEICHNISS DER VON H. ZOLLINGER IN DEN JAHREN 1842–1844 AUF JAVA GESAMMELTEN PFLANZEN, NEBST EINER KURZEN BESCHREIBUNG DER NEUEN GATTUNGEN UND ARTEN, SOLOTHURN. 1845–46.

Gives botanical description of *Pongamia volubilis* (*Derris elliptica*) from Java (p. 3).

Morrison, F. B. (298)

STUDIES ON APPLE INSECTS. N. Y. Agr. Expt. Sta. Ann. Rpt. 47 : 44–46. 1928.

Rosy aphis infestation is noticeably reduced by tobacco dust or Derrisol.

Nagai, K. (299)

[ÜBER ROTENON, EIN WIRKSAMER BESTANDTEIL DER DERRISWURZEL.] Jour. Tokyo Chem. Soc. 23, p. 740. 1902. [In Japanese. Reviewed by Takei in Biochem. Ztschr. 157 : 2. 1925.]

From the root of *Derris chinensis* colorless crystals called rotenone were isolated. These crystals, which melted at 163°, were insoluble in water but soluble in organic solvents. The alcoholic solution was neutral. Analysis and a determination of the molecular weight indicate the empirical formula $C_{18}H_{16}O_5$. The phenylhydrazone $C_{18}H_{16}O_4C_6H_6N_2$ melts at 243°.

Nettai Sangyo Kabushiki Kaisha. (300)

A NEW OR IMPROVED PROCESS FOR OBTAINING INSECTICIDAL OR OTHER TOXIC SUBSTANCES FROM PLANTS OF THE DERRIS SPECIES. Brit. Patent 247,140, issued August 5, 1926; applied for June 25, 1925; in Japan February 4, 1925.

A process for obtaining insecticidal or other toxic substances from plants of the Derris species in solid form consists in collecting fresh juice of crushed fresh roots of the plants, adding water, evaporating the juice at a temperature not exceeding 70° C. and drying it to a solid state. Surplus resinous matters are removed from the juice. The fresh root of tuba is crushed, and after a small quantity of water is added it is filtered. The filtrate is allowed to settle for about three hours in order to allow resinous matters to separate. The supernatant material is then evaporated in a vacuum evaporating pan or an ordinary evaporator at a temperature not exceeding 70°. When pasty, the contents are spread on glass or iron plates and dried in a drying chamber at a temperature of 40° to 45°, until they become a deep-brown, solid mass. The solid mass may be pulverized for convenience of use. The powdered product is a light-brown powder which contains about 30 to 32 per cent of rotenone, 34 to 35 per cent of derrid, and 35 per cent of impurities, such as resin, albumen, gum, and ash. "When it is properly diluted by the addition of the desired quantity of water, it becomes the best insecticide for agricultural purposes."

NEWBOLD, T. J. (301)

POLITICAL AND STATISTICAL ACCOUNT OF THE BRITISH SETTLEMENTS IN THE STRAITS OF MALACCA, VIZ, PINANG, MALACCA, AND SINGAPORE; WITH A HISTORY OF THE MALAYAN STATES ON THE PENINSULA OF MALACCA. v. 2, 508 p. London. 1839.

Describes preparation of the arrow poisons, ipoh krohi, ipoh tennik (or Kennik), and ipoh Mallaye, which contain tuba root as one of the ingredients.

The Kennik arrow poison killed squirrels in 12 minutes, young dogs in from 37 to 40 minutes, and a fowl in 2 hours. Three arrows tipped with the Mallaye preparation, it is affirmed, would kill a man in less than 1 hour and a tiger in less than 3 hours (p. 398–404).

NIEUWENHUIS, A. W. (302)

PFEILGIFTE UND TUBA-FISCHEREI. Quer durch Borneo. v. 1, 493 p., illus. Leiden. 1904.

Describes tuba fishing (p. 192–196) and arrow poisons containing derrid (152–153).

NOZU, R., and SONOYAMA, I. (303)

RESULTS OF STUDIES ON PHAEDON INCERTUM BALY (CHRYSOMELIDAE). Agr. Expt. Sta. Shimane Prefecture, Shimane, Japan, March, 1926. p. 1–162. [In Japanese. Abstract in Rev. Appl. Ent. (A) 14:642. 1926.]

The Chrysomelid, *Phaedon incertum* Baly, is widely distributed over Japan, where it feeds on cruciferous vegetables in the adult and larval stages, causing serious damage. The remedial measures recommended are collecting the adults and spraying with derris mixtures.

OHORI, T., and NAKAZAWA, K. (304)

PROCESS FOR PRODUCING A LIQUID INSECTICIDE CONTAINING EFFECTIVE INGREDIENT OF DERRIS SPECIES. U. S. Patent 1745907, issued February 4, 1930; applied for February 10, 1928; in Japan, February 18, 1927. Assigned to Zaidan Hojin Rikagaku Kenkyujo.

A process for producing a liquid insecticide containing the effective ingredient of Derris species consists in forming a primary material in which the effective ingredient is mixed with an anhydrous and alkali-free material of an oily nature and dissolved in an anhydrous solvent such as benzol, carbon tetrachloride, or trichloroethane, and then mixing the primary material with a soap solution to form a colloidal solution. The following examples are given: (1) To 100 grams of powdered derris root, 10 liters of ether are added to extract the effective ingredient. After extraction is complete, the whole or greater part of the ether is evaporated and recovered. To the residual effective ingredient a mixture of 150 grams of anhydrous and alkali-free fish oil and 150 grams of benzol (as the anhydrous solvent) are added, so that a solution of the effective ingredient in benzol results. This is the improved primary material. The soap solution is easily prepared by, for instance, adding 500 grams of soap to 100 kilograms of water. The solution is mixed with the improved primary material for use. (2) To 1 kilogram of powdered derris root, 5 kilograms of benzol is added, and the effective ingredient of the derris root is extracted by warming the benzol. The benzol is recovered by evaporation. To the residual effective ingredient, a mixture of 600 grams of anhydrous and alkali-free fish oil and 600 grams of carbon tetrachloride (as the anhydrous solvent) are added to form a solution of the effective ingredient. This is the improved primary material. The soap solution may be the same as exemplified in example 1. Trichloroethane as the anhydrous solvent can be used as well. Also in the two examples given, the improved primary material can be easily prepared in the form of powder when 800 grams of anhydrous gum arabic are added.

O'KANE, W. C. (305)

FUNGICIDE AND INSECTICIDE. U. S. Patent 1786125, issued December 23, 1930; applied for May 18, 1927.

The patentee claims a fungicide and insecticide consisting of hydrocarbon white oil carrying a colloidal metal derivative component, such as colloidal cuprous oxide or hydrated oxide. If desired, this refined oil may be used to extract any suitable organic material such as pyrethrum of various species, derris of various species, or other substances that will furnish an additional killing agent effective against insects, or such materials may be added to the refined oil.

OLIVER, D. (306)

FLORA OF TROPICAL AFRICA. v. 2, 613 p. London. 1871.

On pages 244–246 five species of Derris, including *uliginosa,* from tropical Africa, are described.

OXLEY, T. (307)

SOME ACCOUNT OF THE NUTMEG AND ITS CULTIVATION. Jour. Indian Archipelago and East. Asia 2 (10): 641–660. 1848.

Several species of insects lay their eggs on the leaves of nutmeg, but they are not all of equal importance. The species which manifests itself by the discoloration of the leaf, and the larvae of which are embedded in the substance and not on the

Oxley, T.—Continued.

surface, appears the worst, but all ought to be carefully watched and removed or they rapidly spread and cause great havoc amongst the trees. For this purpose it is necessary to wash the leaves with a decoction of tuba root, and syringe them by means of a bamboo with chunam and water of the consistency of whitewash. This adheres to the leaves and will remain even after several heavy showers, giving for the time rather an unsightly appearance to the tree, but making amends by clearing it of the larvae.

Pabisch, H. (308)

UEBER DIE TUBA-WURZEL (DERRIS ELLIPTICA BENTH.). Pharm. Zentralhalle 46 (36): 697–706. 1905.

Describes the microscopical structure of the roots of *Derris elliptica*. Drawings are included.

Palm, B. T. (309)

BEREIDING VAN AKAR-TOEBA EXTRACT. Meded. Deli Proefsta. Medan. ser. 2, no. 42. 1926.

Good results have been obtained in Sumatra with akar-tuba extract as an insecticide (p. 25–26).

(310)

Parman, D. C., Bishopp, F. C., Laake, E. W., Cook, F. C., and Roark, R. C.

CHEMOTROPIC TESTS WITH THE SCREW-WORM FLY. U. S. Dept. Agr. Bul. 1472, 32 p. 1927.

A commercial derris powder repelled 95 per cent of the screw-worm flies visiting a bait of beef liver. This is about the same figure as that obtained with pyrethrum powder.

———. Laake, E. W., Bishopp, F. C., and Roark, R. C. (311)

TESTS OF BLOWFLY BAITS AND REPELLENTS DURING 1926. U. S. Dept. Agr. Tech. Bul. 80, 15 p. 1928.

Derris powder, 0.5 gram, plus kaolin, 4.5 grams, when spread upon 4-ounce cubes of beef liver in a Mason jar repelled 38 per cent of the screw-worm flies and 81 per cent of the Lucilia flies that approached the meat.

Parrott, P. J., and Glasgow, H. (312)

THE ROSY APHID IN RELATION TO SPRAY PRACTICES IN 1929. N. Y. State Agr. Expt. Sta. Bul. 582, 32 p., illus. 1930.

Presents results of experiments designed to ascertain the comparative values of different insecticides in combating the rosy aphid (*Anuraphis roseus* Baker). The results with the derris preparations are as follows:

	Percentage of aphid apples per tree
Lime-sulphur, 1–40; Derrisol, 1 pint to 100 gallons spray mixture	22.17
Lime-sulphur, 1–40; Derrisol, ½ pint to 100 gallons spray mixture; nicotine sulphate, ½ pint	7.39
Bordeaux, 4–4–50; Derrisol, 1 pint to 100 gallons spray mixture	43.90
Check plot	51.65

In past seasons samples of Derrisol, although consistently inferior to nicotine sprays, greatly reduced the aphid population. It would appear that Derrisol is not yet a thoroughly standardized product.

———, Glasgow, H., and MacLeod, G. F. (313)

CONTROL OF APPLE RED BUGS BY DUSTING. N. Y. Agr. Expt. Sta. Bul. 490, 30 p., illus. 1921.

Tests were made with a number of materials against two species of plant bugs, namely, the bright red bug (*Lygidea mendax* Reuter), and the dark red bug (*Heterocordylus malinus* Reuter). A derris-soap compound was used, a commercial preparation assumed to contain approximately one-half pound of powdered derris root and 6 pounds of soap per United States gallon. This derris-soap mixture was used at the rate of 10 pounds to 100 gallons water. Applied at the rate of 13⅓ gallons per tree the derris-soap mixture killed 99.2 per cent of the insects. This same mixture injured in three different tests 6, 6.3, and 14.1 per cent of the apples, the average being 13.2 per cent.

Perredès, P. É. F. (314)

THE ANATOMY OF THE STEM OF DERRIS ULIGINOSA, BENTH., AN EASTERN FISH POISON. Amer. Pharm. Assoc. Proc. 50: 321–332, illus. 1902.

A detailed description.

Persoon, C. H. (315)

SYNOPSIS PLANTARUM, SEU ENCHIRIDIUM BOTANICUM. Pt. 2, 657 p. Paris 1807.

Two species of derris are described (p. 278).

PETTIT, R. H. (316)
REPORT OF THE SECTION OF ENTOMOLOGY. Mich. Agri. Expt. Sta. Ann. Rpt. 1925: 217–225. 1925.

During the spring of 1925 a series of tests was made by L. G. Gentner to determine the comparative and absolute values of various sprays against the black cherry aphis, as well as the various aphids of apple. These tests included trials with derris, miscible oils, and nicotine, used separately and in combination, and were made partly in Benzie County and partly in Ionia County. The results, while encouraging, were not conclusive nor even entirely satisfactory in the test against the cherry aphis. A better kill was secured with the apple aphids (p. 222).

PEYER, W. (317)
EINE NEUE INSEKTIZID WIRKENDE DROGE: DERRIS ELLIPTICA. Chem. Ztg. 54: 724. 1930.

An abstract of a paper presented before the German Natural Scientists' and Physicians' Association held at Konigsburg. The root is described, and petroleum and benzene are suggested as commercial solvents for the active ingredients. For ectoparasites of vertebrate animals, the following mixture is recommended: 8 per cent finest derris powder, 67 per cent tobacco dust, 25 per cent sulphur; or 20 per cent finest derris powder and 80 per cent tobacco dust. For cockroaches, a mixture of finest derris powder with flour and sugar is used as a successful stomach poison. For biting and sucking insects the following spray is recommended: Dissolve one-half kilogram of soap in 100 kilograms of water and scatter it in 1 kilogram of derris powder.

PFAFF, F. (318)
UBER DIE GIFTIGEN BESTANDTEILE DES TIMBÓS, EINES BRASILIANISCHEN FISCHGIFTES. Arch. Pharm. 229: 31–48. 1891.

Two compounds were isolated from Brazilian timbo (identified as *Paullinia pinnata* L.)—a nitrogen-free body called "timboin" and an oil called "timbol." Timboin, melting point 83° C., is very readily soluble in ether, alcohol, benzene, acetic acid, toluene, and carbon disulphide, very soluble in chloroform, very difficultly soluble in petroleum ether, and quite insoluble in water. The formula of timboin is $C_{27}H_{20}O_8$. [As a result of Killip and Smith's explorations (*227*) timbo is now known to be *Lonchocarpus nicou*, the active principle of which is rotenone. Pfaff's timboin was probably impure rotenone.]

POWER, F. B. (319)
THE CHEMISTRY OF THE STEM OF DERRIS ULIGINOSA BENTH., AN EASTERN FISH POISON. Amer. Pharm. Assoc. Proc. 50: 296–321. 1902.

Essentially the same as (*320*).

——— (320)
THE CHEMISTRY OF THE STEM OF DERRIS ULIGINOSA BENTH., AN EASTERN FISH POISON. Pharm. Arch. 5: 145–160, 1902; 6: 1–14, 1903.

Successive extractions yielded the following results: Petroleum ether (boiling point 40–60), 0.93 per cent; ether, 0.33 per cent; chloroform, 0.28 per cent; alcohol, 2.79 per cent; total, 4.33 per cent.

The active principle is a constituent of that part of the resin soluble in chloroform. There were isolated from this resin after treatment with hydrochloric acid in alcoholic solution fine yellow needles, melting point 212° to 213°, very sparingly soluble in cold alcohol and apparently identical with the anhydroderrid of Silleveldt (*366*). Fusion of this resin with potash afforded acetic and valerianic acids. Oxidation of the resin with nitric acid gave behenic acid and oxalic acid.

The chemical constitution of the active principle was not determined. Other compounds identified in the original alcoholic extract of the drug were: Caproic acid, arachidic acid, stearic acid, ceryl alcohol, and two isomers of cholesterol.

QUAINTANCE, A. L., Chairman. (321)
REPORT OF COMMITTEE TO FORMULATE PLANS FOR INVESTIGATIONS OF THE CODLING MOTH FROM BIOLOGIC AND CONTROL STANDPOINTS. Jour. Econ. Ent. 21: 31–38. 1928.

Field tests of derris against the codling moth in New Jersey are being made by E. R. Van Leeuwen. According to Van Leeuwen, derris in laboratory and field tests has shown promise.

——— (322)
REPORT OF COMMITTEE TO FORMULATE PLANS FOR INVESTIGATIONS OF THE CODLING MOTH FROM BIOLOGIC AND CONTROL STANDPOINTS. Jour. Econ. Ent. 22: 24–29. 1929.

Derris has been tested by A. J. Ackerman, Bentonville, Ark.; G. M. List, Colorado Agricultural Experiment Station; W. P. Flint, Illinois State Natural History Survey; B. A. Porter, Vincennes, Ind.; P. M. Gilmer, Wichita, Kans.; E. R. Van Leeuwen and L. C. McAlister, Moorestown, N. J.; and E. J. Newcomer, Yakima, Wash.

Flint reports good results with commercial derris extract combined with white oil, 1¼ per cent. An alcoholic extract of derris used against second brood worms appeared to be of little value (Ackerman, Gilmer, Newcomer, and McAlister).

QUAINTANCE, A. L., Chairman—Continued. (323)

REPORT OF COMMITTEE TO FORMULATE PLANS FOR INVESTIGATIONS OF THE CODLING MOTH FROM BIOLOGIC AND CONTROL STANDPOINTS. Jour. Econ. Ent. 24: 18–23. 1931.

During 1930, field tests against the codling moth were made by Leroy Childs, Hood River, Oreg., with rotenone; by W. P. Flint, Urbana, Ill., and P. M. Gilmer and E. W. Howe, Wichita, Kans., with oil derris.

Flint and Gilmer reported that the addition of derris extract, 1–800, to oil did not materially improve its effectiveness.

In small-scale field tests rotenone has given very poor results (Spuler, Newcomer, Childs). In the laboratory results have varied from good (Spuler) to poor (Lathrop and Sazama). Newcomer reports that rotenone appears effective immediately after application but loses its effectiveness rapidly on exposure.

RAFFLES, T. S. (324)

THE HISTORY OF JAVA. Ed. 2, v. 1, 536 p. London. 1830.

The Coculus indicus and other intoxicating drugs are sometimes thrown into the river, after which the fish are found floating on the surface and easily taken. This method, termed "tûba" is prohibited on large rivers. Jâmprong is the usual term for the procedure in which the fish are afterwards driven down the river into a snare laid below (p. 208–209).

REDECKER, S. B. (325)

SUMATRA AS A SOURCE OF SUPPLY FOR DERRIS OR TUBA ROOT. U. S. Dept. Com., Bur. Foreign and Dom. Com. Spec. Circ. 144. 1926.

"Derrid has been used for years by Chinese and native farmers in Sumatra as an insecticide on vegetable plants, and there is a fairly active trade in the product with these local farmers. Within the last two years the important tobacco estates in the Deli districts of Northern Sumatra, which produce the Sumatra cigar wrapper tobacco, have used increased quantities of Derrid on the tobacco plants for destroying the lice (aphids) attacking the plants. It has been found to be extremely effective for this purpose as it exterminates completely the lice and at the same time does not injure in the least the most tender tobacco leaves. It is reported by the experimental station of the Sumatra tobacco industry that last year all the tobacco estates combined used about 10,000 kilos of Derrid and that the insecticide has proved so effective that they will use approximately 15,000 kilos during the current year. The tobacco estates formerly used a mixture of nicotine for this purpose, but owing to the high cost and scarcity of this product they were obliged to turn to Derrid as a substitute, the use of which will probably continue.

"Another important and increasing use for Derrid is as a body wash for cattle and animals of all kinds, as it has been found entirely effective in exterminating the animal insect pests and at the same time does not injure the skin of the animal. However, when the animal is suffering from a skin disease such as scurf, Derrid can not be used, as it is then injurious to the animal.

"The present price of Derrid in Medan is approximately 0.8 florins per kilo, equivalent to 15 cents United States currency per pound. When exported the roots are simply tied together and placed in heavy gunny sacks."

REES, A. (326)

THE CYCLOPAEDIA; OR, UNIVERSAL DICTIONARY OF ARTS, SCIENCES, AND LITERATURE. v. 11, London. 1819.

Gives botanical description of Derris and in particular of *D. pinnata.*

RICHARDSON, C. H. (327)

INSECTICIDE STUDIES DEVELOP MANY NEW WAYS TO KILL PESTS. U. S. Dept. Agr. Yearbook 1927: 389–393. 1928.

Derris, a comparatively new insecticide of plant origin, has given excellent results in the control of cattle grubs and of fleas on domestic animals. Tests have demonstrated that derris extract is very effective against leaf hoppers on leatherleaf ferns in Florida.

——— (328)

INSECTICIDES. Ann. Survey Amer. Chem. (1927–28) 3: 226–245. 1928.

On page 241 the author refers briefly to the papers of Quaintance (*321*), Daniel (*87*), Hough (*192*), and DeLong (*95*).

RIDLEY, H. N. (329)

A LIST OF MALAY PLANT NAMES. Jour. Straits Branch Roy. Asiatic Soc. 30: 31–283. 1897.

Akar is defined as any climbing plant (p. 35). The word also signifies the root of a plant. Tuba is defined as *Derris elliptica* Benth. (p. 274).

——— (330)

INSECTICIDES, NUTMEGS AND MACE, AND PEPPERS. Spices. 449 p., illus. London. 1912.

Tuba root is one of the best insecticides and is the one most regularly used by the Chinese in the Malay Peninsula for treating their vegetable and other crops. The

RIDLEY, H. N.—Continued.

plant known as tuba (*Derris elliptica*) is a woody climber, propagated by cuttings. It will grow in any corner of the garden and soon develops into a fairly large mass of stems, lying on the ground. The roots are pounded up in water, and the decoction is poured or sprayed over the crop, where it will kill all caterpillars, grasshoppers, and other insects. It is perfectly harmless to any plants. The decoction is poisonous to human beings, but only when taken in large quantities, and risk from it in the case of spice plants is infinitesimal (p. 8–9).

In Sarawak a small, flattened, green bug, having its sides fringed with tiny spines has been found. It is an immature form, probably of some species of Centrocnemis. The insect is a very sluggish animal but a serious pest. The best method of dealing with this class of animal is to spray the vines with a decoction of tuba root (*D. elliptica*), or some of the well-known insecticides, such as nicotine (p. 273).

——— (331)

THE FLORA OF THE MALAY PENINSULA. v. 1. London. 1922.

Derris elliptica and other species of derris growing in the Malay Peninsula are described (p. 595–598).

RIPLEY, L. B. (332)

TOP-DRESSING OF MAIZE AGAINST STALK-BORER. RESULTS OF TESTS. Farming in South Africa 1: 153–154. 1926.

An attempt is being made by an industrial company to grow derris in South Africa. Derrisol is more toxic than 40 per cent nicotine sulphate; the highest concentration of Derrisol economically practicable for use on a large scale is 1 to 150. Kymac, a sheep dip containing derris extract as one of the active ingredients, burns plants at 1 to 300 and is not quite toxic enough to the borers at this strength. Derris dust, calcium fluosilicate, cryolite, and calcium arsenate will be tested next season. Sodium fluosilicate burns badly.

Recommendation: "If you wish to avoid burning the young maize, use derrisol 1 to 150. It will cost 7 to 10 shillings per acre, exclusive of labor."

——— (333)

TOP-DRESSING MAIZE AGAINST STALK-BORER—UNEXPECTED DAMAGE WITH DERRISOL. Farming in South Africa 1: 392. 1927.

In (*332*) it was pointed out that of many substances studied, Derrisol was the only one that did not burn the plants at a strength which was sufficiently effective against the borer. This substance was therefore regarded as the most promising of the many tried, although its cost (7 to 10 shillings) was somewhat too high. The author states that a case of severe injury to maize, following the use of Derrisol, has recently been noticed. The damage is not that of burning but a delayed and peculiar type of plant poisoning. This did not occur in the Cedara experimental plots even when Derrisol was used very much stronger than the strength recommended for trial. Pending thorough investigation of this inexplicable result, farmers are advised not to use this substance on maize. For other purposes, however, as advised by manufacturers, Derrisol was found to be an excellent insecticide. (The manufacturers have not advised its use on maize.)

——— (334)

TOP-DRESSING MAIZE AGAINST STALK-BORER. Farming in South Africa 2: 613–616. 1928.

Reference is made to previously reported results on derris and Kymac, a sheep dip which contains derris. In the tests reported in this article, four different substances were used, namely, Kymac, Kerol, arsenite of soda, and sodium fluosilicate. The author concludes that Kymac diluted 1 to 250 may be safe as a top-dressing for maize when used at the rate of a tablespoonful of liquid (10 cubic centimeters) per plant.

——— and HEPBURN, G. A. (335)

TOP-DRESSING MAIZE AGAINST STALK-BORER. Farming in South Africa, 3: 933–934, 942. 1928.

Cryolite diluted with an inert powder at the rate of 1 to 100 is not nearly so effective against the stalk borer as when diluted with water at the rate of 1 to 600. With powdered derris root the situation is similar. When applied in water at 1 to 90 it is much more effective than when used as a powder at 1 to 12. The killing power of a dry powder under the conditions of top-dressing is far below that of the same powder diluted to the same extent but applied as a suspension in water. This is perhaps explained by the fact that when suddenly wetted by a liquid the borers swallow some of it (as is easily shown by using a colored liquid and dissecting the digestive system after dipping), whereas they do not appear to swallow a dry powder very readily. Thus the liquid can act as a stomach poison more effectively than the powder.

Pulvex (ground derris root) applied as a suspension in water is extraordinarily toxic to the stalk borer. As it does not burn foliage, the concentration that can be used is limited by cost. If Pulvex is diluted at the rate of 1 to 450 by weight it costs about the same per acre as Kymac 1 to 250, namely, about one-half penny per acre. It is found that at these strengths the two substances are equal in killing power. One of the chief ingredients in Kymac is derris extract.

RIPLEY, L. B., and HEPBURN, G. A.—Continued. (336)

A NEW INSECTICIDE AGAINST MAIZE STALK-BORER. Farming in South Africa, 5: 285–287. 1930.

To determine the effect upon the yield of treating maize plants heavily infested with the maize stalk borer, twelve ⅕-acre plots were laid out in a uniform stand. Six were top-dressed, the remaining six being left as controls. Kymac paste, 1 pound to 25 imperial gallons, Cryolite, 1 pound to 60 gallons, and Pulvex, 1 pound to 40 gallons were used. Two of the six plots were treated with each insecticide. Kymac gave an increase over the controls of 27 per cent; Cryolite, 26 per cent; Pulvex, 13 per cent. Pulvex is the only one of these insecticides that is harmless to foliage. A new Derrisol has been brought out and is recommended as superior to the three products previously advocated for the control of the maize stalk borer. The addition of a resin soap to the new Derrisol reduced the toxicity to a marked degree. Derrisol is recommended for use at the rate of 1 part to 1,000 parts of water, by measure. One imperial gallon of Derrisol is sufficient to top-dress about 45 acres. Preliminary experiments with a mixture of cryolite and Derrisol gave promising results.

ROARK, R. C. (337)

PLANTS USED AS INSECTICIDES. Amer. Jour. Pharm. 91: 25–37, 91–107. 1919.

D. elliptica and *uliginosa* are listed as insecticidal plants (p. 36–37).

——— (338)

ECONOMIC ASPECTS OF THE USE OF INSECTICIDES. Chem. Markets 22: 303–304. 1928.

No figures on the consumption of derris products in the United States are available.

——— (339)

RECENT PROGRESS IN THE CHEMISTRY OF DERRIS. Jour. Econ. Ent. 22: 378–381. 1929.

A review of the work of the following: Nagai (*299*), Takei (*386, 387, 388*), Butenandt (*64*), Wright (*453*), Fryer, Stenton, Tattersfield, and Roach (*118*), and Van Hasselt (*177, 178*).

——— (340)

SOME RECENTLY PROPOSED STOMACH INSECTICIDES. A REVIEW OF THE PATENT LITERATURE. Fourth Internatl. Congr. Ent. Trans. v. 2, p. 730. (Edited by K. Jordan and W. Horn.) 1929.

The author calls attention to the root of *Derris elliptica* as a material worth testing as a stomach insecticide. References to patents covering processes of preparing derris extracts are given.

——— (341)

VALIOSAS PLANTAS INSECTICIDAS SUDAMERICANAS. Bol. Union Panamericana 63: 1298–1299. 1929.

Mentions rotenone as a valuable insecticide occurring in derris, Lonchocarpus, cube, and timbo and suggests the cultivation of these plants in South America.

——— (342)

NEW INSECTICIDES DEVELOPED TO IMPROVE CROP PROTECTION. U. S. Daily, v. 4, p. 8, January 23, 1930.

Refers to the work of the insecticide division with rotenone and to its occurrence in cube.

——— (343)

INSECTICIDES AND FUNGICIDES. Ann. Survey Amer. Chem. (1928–29) 4: 358–382. 1930.

Briefly reviews articles by Roark (*339, 341*), Clark (*74*), LaForge and Smith (*237*), and Haseman (*176*).

——— (344)

THE AMERICAN MARKET FOR TUBA ROOT (DERRIS ELLIPTICA). Malayan Agr. Jour. 18: 455–458. 1930.

Growers are urged to produce derris root of high rotenone content. A chemical method of determining rotenone in derris root is given. The cultivation of Lonchocarpus (cube) in the Federated Malay States and the marketing of derris as an extract rather than as a crude root are suggested. Recent work on rotenone and the other constituents of derris is reviewed.

——— (345)

DERRIS, CUBE, AND TEPHROSIA AS INSECTICIDES. A REVIEW OF AMERICAN AND FOREIGN PATENTS. Soap 6: 105, 107, 109. 1930.

Abstracts American and foreign patents relating to derris, cube, and tephrosia.

ROARK, R. C.—Continued. (346)

PROBLEMS IN THE PRODUCTION AND USE OF INSECTICIDES IN THE SOUTH. Jour. Chem. Ed. 7: 2301–2306. 1930.

Attention is called to the possibility of growing derris and Lonchocarpus in southern Florida.

——— (347)

GENUINE DERRIS ROOT MAY CONTAIN NO ROTENONE. Jour. Econ. Ent. 24: 328–330. 1931.

Authentic specimens of derris root have been found to contain no rotenone. The total ether extract of derris root may range from 5 to 23 per cent and the rotenone content from 0 to 5½ per cent. but there is no consistent relation between these. Cube root has been found to contain up to 7.6 per cent rotenone. A cube extract may soon be commercially available.

——— (348)

THE INSECTICIDE POSSIBILITIES OF DERRIS ROOT. Soap 7: 97, 99, 101. 1931.

Attention is called to the possibilities of rotenone both as a contact and a stomach insecticide, to its harmlessness to mammals when eaten by them, to recent work on its structure, and to the patents relating to rotenone-bearing plants.

———, PARMAN, D. C., BISHOPP, F. C., and LAAKE, E. W. (349)

REPELLENTS FOR BLOWFLIES. Indus. and Engin. Chem. 19: 942. 1927.

Derris powder when undiluted repelled 95 per cent of the screw-worm flies visiting fresh beef liver, and when diluted with nine parts of kaolin it repelled 38 per cent.

ROSENTHAL, D. A. (350)

SYNOPSIS PLANTARUM DIAPHORICARUM. Systematische Uebersicht der Heil.—Nutz—und Giftpflanzen aller Länder. 1,359 p. Erlangen. 1861.

Derris uliginosa is said to be used in Java as a medicine and for stupefying fish (p. 1026).

ROTHAMSTED EXPERIMENTAL STATION. (351)

ROTHAMSTED EXPERIMENTAL STATION, HARPENDEN. Ann. Rpt. 1925–26.

Refers to the work of Tattersfield and Gimmingham with insecticidal plants. *Derris elliptica*, the tuba root of Malay, and haiari, from British Guiana, have yielded a poisonous resin and a colorless, crystalline substance, tubatoxin, which is excessively poisonous to insects (p. 47–48).

——— (352)

ROTHAMSTED EXPERIMENTAL STATION, HARPENDEN. Ann. Rpt. 1927–28.

Mentions investigations designed to develop new insecticides. Four plants are especially promising—derris from Malay, which contains poison in its roots; tephrosia, from tropical Africa; a climber, haiari (both white and black varieties), from the forests of British Guiana; and pyrethrum, the only one which grows in temperate regions (p. 51–54).

ROXBURGH, W. (353)

HORTUS BENGALENSIS, 105 p. Serampore. 1814.

Describes *Galedupa uliginosa* (*Derris uliginosa*) on page 53.

——— (354)

FLORA INDICA; OR DESCRIPTIONS OF INDIAN PLANTS. v. 3, 875 p. London and Calcutta. 1832.

A botanical description of five species of Galedupa, including *G. elliptica* (*Derris elliptica*) and *G. uliginosa* (*D. uliginosa*) (p. 239–243).

RUMPHIUS, G. E. (355)

HERBARIUM AMBOINENSE, AMSTERDAM. Pt. 5, 492 p., illus. Amsterdam. 1747.

Describes akar tuba (*Derris elliptica*) under the name of tuba radicum and mentions its use as a fish poison (p. 37–38).

RUSSELL, H. L. (356)

WHAT'S NEW IN FARM SCIENCE. Wis. Agr. Expt. Sta. Ann. Rpt. (1927–28), Bul. 405, 128 p. 1929.

Many kinds of predaceous insects attack the cherry aphids (*Myzus cerasi* Fabr. and help to limit the degree of infestation, but their unaided efforts are not sufficient for commercial control of the pest. This can be accomplished with contact sprays, nicotine sulphate, or Derrisol, applied early in the season before the cherry leaves unfold (p. 119).

RUSSELL, H. L., MORRISON, F. B., and EBLING, W. H. (357)

STUDIES OF THE BLACK CHERRY APHID, GLEANINGS FROM SCIENCE. Wis. Agr. Expt. Sta. Bul. 388, 145 p. 1926.

A number of experimental sprayings were made in the spring of 1926, and a variety of insecticides were used on the black cherry aphid, *Myzus cerasi.* It was found that the petal spray is probably the best for cherry aphids control and a new insecticide, Derrisol, imported from England, seemed to possess superior qualities (p. 64).

SARASIN, F., and ROUX, J. (358)

NOVA CALEDONIA, RECHERCHES SCIENTIFIQUES EN NOUVELLE-CALEDONIE ET AUX ILES LOYALTY. Bul. Bot. 1, pt. 2, 176 p., illus. Berlin and Wiesbaden. 1920.

Describes *Derris uliginosa* from the Loyalty Islands (p. 157).

SCHMITT, N. (359)

DERRIS ELLIPTICA BENTH., EIN VEGETABILISCHER UND UNGIFTIGER INSECTICIDLIEFERANT. Angew. Bot. 12: 453–463. 1930.

A general description of *Derris elliptica,* its cultivation, and use as an insecticide. Cuttings of derris are being grown in the Frankfort Palm Garden and the botanical garden in Nymphenburg near Munich, Germany. It is reported that a derris plantation has been established in the vicinity of Laguna, Philippine Islands. Some good photographs of derris plants and roots are shown.

If chewed, the root has a peculiar metallic taste, slightly sourish aromatic. It has an astringent action, and after about half an hour produces on the tongue a lasting numbness, which extends into the pharynx.

SCHWARTZ, B., and SHOOK, W. B. (360)

RABBIT PARASITES AND DISEASES. U. S. Dept. Agr. Farmers' Bul. 1568, 30 p. 1928.

For combating fleas on rabbits the animals should be dusted with pyrethrum powder, with powdered naphthalene, or powdered derris root which should be used in the same way as in treating for lice with pyrethrum (p. 10).

SEEMANN, B. (361)

VITI: AN ACCOUNT OF A GOVERNMENT MISSION TO THE VITIAN OF FIJIAN ISLANDS IN THE YEARS 1860–61. 447 p., illus. Cambridge. 1862.

The materials employed by the natives for poisoning, or rather stupefying fish, a custom as prevalent all over Polynesia as it is among the Indians of America, are the square fruit of the Vutu rakaraka (*Barringtonia speciosa,* Linn.) and the stem and leaves of the Duva gaga (*Derris uliginosa*). Both plants grow in abundance on the sea beach just above high-water mark. As soon as these materials, pounded to render them more efficacious, are thrown into the water, or drawn through it by means of a line or creeper to which they have been attached, the fish turn on their back and rise to the surface. They are stupefied and are thus easily taken. They soon recover their lost activity and are believed not to die from the effects of this treatment (p. 339).

——— (362)

PLANTAE VITIENSES, BONPLANDIA. v. 10, no. 19, 372 p., illus. London, New York [etc.]. 1862.

Derris uliginosa from the Fiji Islands is described (p. 296).

——— (363)

FLORA VITIENSIS. 453 p., illus. London. 1867–1873.

Describes *Derris uliginosa* from the Fiji Islands. It is plentiful on the sea beach, and by its long running rootstock helps to keep the beach together. The leaves are pounded and thrown into the water by the natives for the purpose of first stupefying, and then catching fish, the process being the same as practiced by the American Indians on the Isthmus of Panama, and elsewhere (p. 65).

SHARPLES, A. (364)

ANNUAL REPORT OF THE MYCOLOGIST FOR 1922. Malayan Agr. Jour. 11: 267–272. 1923.

Diseased plants of tuba root have been under observation (p. 271).

SHUTT, F. T. (365)

REPORT OF THE DOMINION CHEMIST (CANADA) FOR THE YEAR ENDING MARCH 31. Dept. of Agr., Dominion Experimental Farms, 84 p., 1927.

Among the samples received for analysis was a dark-colored, odoriferous liquid insecticide, strongly alkaline. This was submitted by the dominion entomologist, and was manufactured by A. St. Leger, Lago Maggiore, Italy. Upon analysis it was found to be a sulphonated tar oil neutralized with ammonia, and containing apparently the active principle of derris root, rotenone. This is one of the more newly introduced insecticides under investigation by the entomological branch.

A sample of derris root, which was a finely ground, yellow powder, was submitted for analysis by A. Kelsall, entomological laboratory, Annapolis Royal, N. S.

Shutt, F. T.—Continued.

The following results were obtained: Moisture, 6.48 per cent; ether extract, 8.79; methoxyl content, 14.90;[4] alcohol extract,[5] after ether extract, 14.25.

This newly introduced insecticide is regarded as a contact and stomach poison (p. 71–72).

The pieces of root on arrival in Canada are quite dry, indicating a drying up of the sap and the consequent coagulation of the poisons. For this reason the root should be ground to an impalpable powder and special means taken that it is thoroughly dispersed throughout the spray fluid. For maximum efficiency the use of organic solvents, for example, wood spirit, is advisable.

Derris is quite poisonous to the lower forms of life; in moderate doses it is nonpoisonous to man. Its uses are many. It has been found very effective as a moth preventive, as an exterminator of lice and fleas, and also as an agent in mosquito-control work. In experiments with a number of dusts as mosquito controls, finely ground derris root was found to be highly effective against the larvae.

Sillevoldt, H. E. T. van (366)

UEBER DAS DERRID UND PACHYRHIZID; EIN BEITRAG ZUR KENNTNIS DER INDISCHEN FISCHGIFTE. Nederland. Tijdschr. Pharm. 11: 246–256; and Arch. Pharm. 237: 595–616. 1899. (Inaug. Diss., Marburg, 1899.)

The stupefying fish poisons occur mainly in plants of the family of *Papilionaceae.* Derrid, $C_{33}H_{30}O_{10}$, prepared from the root of *Derris elliptica,* by treating with water, extracting with alcohol, evaporating, and treating the residue with ether, is a pale yellow substance. It melts at 73° C., and is easily soluble in the usual organic solvents, slightly so in light petroleum, and insoluble in water. The alcoholic solution has a faintly acid reaction. Derrid is dissolved by sulphuric acid, forming a brownish-violet solution, from which it is reprecipitated by water. It appears to combine with phenylhydrazine. By boiling with an alcoholic solution of hydrogen chloride it forms an anhydro derivative, $C_{33}H_{28}O_9$, which is also present in crude derrid. This is not dissolved by ether. This compound forms small needles, melting at 214°, and when treated with hydriodic acid it forms a compound, $C_{30}H_{19}O_6(OH)_3$, which melts at 240°.

The preparation of pachyrhizide, $C_{30}H_{24}O_{10}$, from the seeds of *Pachyrizua angulatus,* Rich., is similar to that of derrid. Pachyrhizide melts at 81°, and closely resembles derrid. A compound, $C_{29}H_{20}O_9$, which is insoluble in ether and melts at 196° is also contained in the seeds. The anhydro derivative of pachyrhizide, $C_{30}H_{22}O_9$, obtained by warming it with an alcoholic solution of hydrogen chloride, is a crystalline substance which melts at 182°. It combines with phenylhydrazine, and contains two methoxyl groups.

Derrid and pachyrhizide appear to belong to the same homologous series as Pfaff's timboin, for which the formula $C_{34}H_{32}O_{10}$ may be calculated from his analyses.

Smith, K. N., and Wadsworth, J. T. (367)

THE CARROT AND ONION FLIES. SOME PRELIMINARY ATTEMPTS AT THEIR CONTROL. Fruit Grower 51: 575–578, 616–618. 1921.

Four applications of a powder composed of soot and derris at the rate of 1 ounce derris plus 2 ounces soot per square yard resulted in 95 per cent clean carrots. The control plot yielded only 20 per cent carrots free from infestation by the carrot fly (*Psila rosae*). This derris mixture gave the best control of any of the materials tried.

Used against the onion flies (*Hylemyia antiqua*) in the same way 6 applications of derris root mixture (2 parts soot and 1 part derris) at the rate of 1 ounce per square yard gave 60 per cent clean onions, whereas soot alone gave only 16 per cent clean onions.

Smith, L. E., and LaForge, F. B. (368)

ROTENONE. X. CLEAVAGE OF DERRITOL AND ROTENOL. Jour. Amer. Chem. Soc. 52: 4595–4598 1930.

Methylderritolic acid yields on alkaline peroxide oxidation a monocarboxylic acid of formula $C_{11}H_{14}O_5$ having the properties of a trimethoxyphenylacetic acid which yields the next lower homolog by permanganate oxidation. The new acid corresponds in its empirical formula to a trimethoxybenzoic acid but does not agree in its properties with any of the four known compounds of this type. It therefore probably corresponds to either the 2, 3, 5 or 2, 3, 6 derivative, both of which are unknown.

Dihydrorotenolic acid on peroxide oxidation yields a monocarboxylic acid of formula $C_{12}H_{14}O_5$ containing the two methoxyl groups of rotenol.

Smith, R. H. (369)

EXPERIMENTS WITH TOXIC SUBSTANCES IN SPRAY OILS IN CONTROLLING RED SCALE. Calif. Citrogr. 14: 315, 326. 1929.

Tests were made against red scale on lemon trees with nicotine and extracts of pyrethrum, derris, three species of Tephrosia, and two species of Lonchocarpus, in a highly refined kerosene. No combination showed any practical value.

---

[4] The percentage of ether extract per se can not be regarded as a measure of the toxicity of the sample, but considered in conjunction with methoxyl content, it serves toward a decision in respect to genuineness and strength.

[5] Gives a general indication of the nontoxic constituents having some value as emulsifying or wetting agents. The percentage found is high, indicating that this sample possesses high emulsifying properties, confirmed later by actual use of the root in spray preparations.

SONAN, J. (370)

STUDIES ON THE INSECT PESTS OF THE TEA PLANT. PART II. Formosa, Taihoku, Dept. Agr. Research Inst. Rpt. 29, 132 p. 1927. [In Japanese. Abstract in Rev. Appl. Ent. (A) 16: 482–483, 1928.]

Spraying with derris and soap or nicotine sulphate and soap proved very effective against the following pests infesting tea plants in Formosa; Lymantriids, *Euproctis pseudoconspersa,* Strand; *E. sericea,* Wileman; *Porthesia taiwana,* Shir; P. *scintillans,* Wlk.; *Pseudodura dasychiroides,* Strand; *Olene mendosa,* Hb.; *Notolophus posticus,* Wlk.; *Stilpnotia cygna,* Moore; and *Arctornis alba,* Bremer.

SOUTH, F. W. (371)

SHORT REPORT ON THE WORK OF THE INSPECTION STAFF, SECOND HALF YEAR—1920. Fed. Malay States Dept. Agr. Bul. 8, no. 4, p. 256–258. 1920.

In Perak, during October and November, experiments were conducted on the control of Bena Kura (*Podops coarctata*), a medium-sized brown bug; stem borers (*Schoenobius bipunctifer* and other species); and the mole cricket (*Gryllotalpa* sp.). Spraying with kerosene emulsion and extract of tuba root (*Derris* sp.) was tried. The results were uncertain. Lamp traps were also employed, with some success in the case of stem borers and mole crickets.

——— (372)

REPORT ON THE WORK OF THE INSPECTION STAFF, JULY TO SEPTEMBER, 1922. Malayan Agr. Jour. 10: 264–268. 1922.

For dealing with the pest *Nymphula depunctalis* in the nurseries spraying is being carried out with a decoction of tuba root.

——— (373)

ANNUAL REPORT OF THE CHIEF AGRICULTURAL INSPECTOR FOR 1923. Malayan Agr. Jour. 12: 219–237. 1924.

"Tuba (*Derris elliptica,* Be[n]th.):—A Japanese estate on the Johore river is cultivating this plant on a large scale and is putting a root extract on the market."

——— (374)

ANNUAL REPORT OF THE CHIEF FIELD OFFICER, 1924. Malayan Agr. Jour. 13: 189–302. 1925.

"Tuba (*Derris* spp.) is grown on certain Japanese estates in Johore and on a small scale in a few other localities in the Federated Malay States."

——— (375)

ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE, STRAITS SETTLEMENTS AND FEDERATED MALAY STATES FOR THE YEAR 1927. 18 p. 1928.

The comparatively little known insecticide tuba (*Derris elliptica,* Malayan tuba puteh, and *D. malaccensis,* Malayan tuba merah), is engaging the attention of investigators in various countries. Samples and trial shipments have been dispatched, which it is hoped will eventually lead to established markets in different parts of the world.

The area planted with this crop in Johore has been extended, so that in 1927 it comprised about 1,400 acres. In the Federated Malay States there were more than 700 acres under tuba.

A study has been begun of the insecticidal value of different varieties of tuba. The toxic values obtained at Rothamsted with ethereal extracts of the dry root are being compared with those obtained with aqueous extracts of fresh roots, of known age, grown on the plots at Serdang (p. 11).

SOUTHARD, A. E. (376)

BORNEO AND MALAY ARCHIPELAGO SOURCE OF DERRIS OR TUBA ROOT. U. S. Dept. Com., Bur. Foreign and Dom. Com., World Trade Notes on Chemicals and Allied Products 1 (41): 7. 1927.

In 1925 derris was grown on 500 acres in the Federated Malay States and on 600 acres in Johore. In Borneo the acreage under cultivation is probably somewhat larger. Estate owners ask 24 cents per pound for the cultivated product, but considerable quantities may be bought from native collectors for 10 to 12 cents per pound. The freight rate on tuba root to New York is $17 per ton. Much derris has been shipped to Australia for use as sheep dip.

SPRENGEL, C. (377)

SYSTEMA VEGETABILIUM. Ed. 16, v. 3, 936 p. Göttingen. 1826.

Tephrosia uliginosa (*Robinia uliginosa* Roxb. W.; *Derris uliginosa*) is described (p. 232).

SPRING, F. G. (378)

ANNUAL REPORT OF THE AGRICULTURIST FOR 1922. Malayan Agr. Jour. 11: 285–290. 1923.

"The Ministry of Agriculture and Fisheries, London, reports that there is, as yet, no trustworthy information concerning the relative toxic contents of different

SPRING, F. G.—Continued.

species of Derris or of the varieties of the species *Derris elliptica*, since botanic specimens have not been obtainable. Every endeavour is to be made by this Department to obtain suitable botanical specimens for purposes of identification. The Ministry further states that it is at present too early to answer definitely as to the probable demand for the product; but there is no doubt that Derris has valuable insecticidal properties and that it will take its place among the older insecticides, if it is handled in a sound manner [commercially]. An article on Derris [tests] carried out jointly by the Ministry's Pathological Laboratory and the Rothamsted Experimental Station will appear in a forthcoming number of the Annals of Applied Biology. This crop can be successfully grown in Malaya and is extensively used by Chinese market gardeners as an insecticide."

SPULER, A., STRAND, T., DORMAN, R., GILLIES, K., and BRANNON, D. (379)

VALUE OF COMBINATIONS WITH LEAD ARSENATE AND SUMMER OILS IN CODLING MOTH CONTROL. Northwest Fruit Grower 2 (39): 4, 5, 9, 11, 12. 1930.

The use of spreaders, fish oils, mineral oils, nicotine, derris and pyrethrum compounds in combination with lead arsenate for codling moth control has given variable results. They have frequently caused considerable injury to fruit and foliage.

STOCKDALE, F. A. (380)

RECENT RESEARCH ON EMPIRE PRODUCTS . . . Bul. Imp. Inst. [London] 26: 78–85. 1928.

"For some years interest has been taken in Malaya and Sarawak in species of Derris, the extracts from the roots of which have proved to have valuable insecticidal properties. A representative of a firm of dealers in insecticides and cattle dips has recently visited Ceylon, and with the assistance of the Systematic Botanist has been able to study the Ceylon species of Derris and to secure samples for investigation. *Derris scandens*, *Derris Benthamii*, and *Derris uliginosa* are reputed locally to be fish poisons, but these investigations showed that *Derris Benthamii*, known in Sinhalese as Miung-Kalawel and in Tamil as Karaputekel, is the most common species used . . ." (p. 78–79).

——— (381)

RECENT RESEARCH ON EMPIRE PRODUCTS. MISCELLANEOUS VEGETABLE PRODUCTS. Bul. Imp. Inst. [London] 26: 222–223. 1928.

"Three types of tuba root are under trial at the Government Experimental Plantation, Serdang, namely, *Derris elliptica* (Malay 'Tuba Merah'). *Derris malaccensis* (Malay 'Tuba Puteh'), and *Derris malaccensis* var. (an erect form from Sarawak).

"Work is in progress to determine the relative value of these different types in the preparation of an insecticide. For a study of the value of the tuba root as an insecticide, it appears to be desirable to obtain more information concerning the value of aqueous extracts of the kind in common use locally. A comparison is being made of the results obtained at Rothamsted by the use of dry partly aged roots with the results obtained here by the use of fresh aqueous extracts from roots of known history."

STRICKLAND, C. (382)

HALF-YEARLY REPORT OF THE TRAVELING ENTOMOLOGIST TO THE FEDERATED MALAY STATES. Unpublished Report to the Secretary of State for the Colonies. [Abstract in Rev. Appl. Ent. (B) 1: 18. 1913.]

The question of the utility of tuba root (the aerial root of *Derris elliptica*, one of the Leguminosae) as a larvicide (Anopheline larvae) is under investigation. It is much used by the Malays for killing fish.

SYMES, C. B. (383)

INSECT PESTS OF MUSHROOMS. PART I. THE MUSHROOM FLY (SCIARA PROECOX, MEIG.). Fruit Grower 51: 142–145, 188–190, 234–236. 1921.

Pure derris powder applied to a bed of mushrooms infested with the mushroom fly (*Sciara proecox* Meig.) cleared the bed of insects in two or three days, but had no effect upon Hypomyces fungi.

It is concluded that mushrooms will not stand treatment with powder insecticides (such as pyrethrum, derris, and 1 per cent paradichlorobenzene). When not checked in their growth by these powders, the mushrooms are rendered absolutely unfit for market (p. 235).

——— (384)

NOTES ON THE BLACK CITRUS APHIS. Rhodesia Agr. Jour. 21: 612–626, 725–737. 1924.

Within the last few years derris extract, a proprietary preparation, has come forward as a substitute for nicotine in the control of the black citrus aphis. Experiments with two preparations containing this substance have been carried out by the writer. The results were highly satisfactory. Derris is nonpoisonous to the higher animals (p. 735).

Takai, S. (385)

STUDIES ON THE FAMILY ZYGAENIDAE. I. THE LIFE-HISTORY OF PRYERIA SINICA MOORE. Research Bul. Gifu Imp. Col. Agr. 3, p. 1–40. 1928. [In Japanese. Abstract in Rev. Appl. Ent. (A) 17: 565, 1929.]

Sprays of derris or pyrethrum may be used for control, but arsenicals are more effective.

Takei, S. (386)

THE CONSTITUENTS OF DERRIS ROOT. I. Bul. Inst. Phys. and Chem. Research [Tokyo] 2: 485–496. 1923. [In Japanese. Abstract in Chem. Abs. 18: 685, 1924.]

The alcohol extract of 100 grams *Derris elliptica,* produced in Singapore, becomes a milky liquid when diluted with water to 2 liters. It acts as a powerful insecticide. It becomes inactive when kept in water solution, but not in alcohol. When extracted with ether, powdered derris root gives hexagonal plates with a melting point of 163° C., which is the same as that of tubotoxin. The yield is 1.5 to 6 per cent of the material. The minimum lethal amount of the crystals is 0.00125 gram per 100 grams of white rat. The formula was determined to be $C_{19}H_{18}O_5$. Former investigators have given it as $C_{18}H_{18}O_5$. The phenylhydrazone is yellow and melts at 243° to 245°. When treated with concentrated sulphuric acid, it is changed into an isomer, colorless needles melting at 177° to 178° and having no poisonous properties. When it is saponified with 3 per cent hot alcoholic potassium hydroxide, a substituted hydroxybenzoic acid, $C_{10}H_{10}O_3$, melting at 128° to 129°, is obtained. This absorbs bromine and is colored violet with ferric chloride. If the saponification is conducted under a current of hydrogen an isomer with a melting point of 209° to 210° is obtained. It has no poisonous action. When subjected to potassium hydroxide fusion, tubatoxin itself or the acid obtained above another substituted hydroxybenzoic acid having the melting point 182° and the formula $C_9H_{10}O_3$. It sublimes about 160°. It is considered to be a $HOC_6H_2Me_2CO_2H$.

——— (387)

ÜBER ROTENON DEN WIRKSAMEN BESTANDTEIL DER DERRISWURZEL (DERRIS ELLIPTICA, BENTH.). Biochem. Ztschr. 157: 1–15. 1925.

By extraction of derris root with alcohol or ether a substance, (I), $C_{19}H_{18}O_5$, melting at 163° C, and identical with tubatoxin, was obtained. It reduced Fehling solution. The phenylhydrazone melts at 243° to 245°. By the action of concentrated sulphuric acid on rotenone an isomer was obtained as needles melting at 177° to 178°. In contrast to rotenone, this substance was not toxic to rats. Rotenone with alcoholic potassium hydroxide gave needles (II), melting at 128° to 129°, of the composition $C_{10}H_{10}O_3$ (?), and this compound fused with potassium hydroxide, gave rotenic acid (III), $C_9H_{10}O_3$, melting at 182°, a hydroxy-mesitylenic acid. Concentrated nitric acid on rotenic acid gave a nitro compound $C_9H_9O_3NO_2$, which melted at 168°. Rotenone with chromic acid and acetic acid or acetic anhydride gave needles $C_{18}H_{16}O_5$, melting at 232° to 233°. This also reduced Fehling solution. Rotenone when heated with chromic acid and acetic acid gave rotenonone, $C_{17}H_{14}O_5$, melting point 298°. Alcoholic potassium hydroxide on this gave an acid $C_{17}H_{16}O_6$, melting point 250°, showing rotenone to be a lactone. By reducing rotenonone with zinc and acetic acid, there was obtained a substance $C_{17}H_{16}O_5$, melting at 198°.

——— (388)

ÜBER ROTENON, DEN WIRKSAMEN BESTANDTEIL DER DERRISWURZEL. Ber. Deut. Chem. Gesell. 61: 1003–1007. 1928.

Rotenone is represented by the formula $C_{23}H_{22}O_6$. Concentrated sulphuric acid converts it into isorotenone, which melts at 177° C. It is an ethylene (cis-trans) isomer. Rotenone hydrochloride is converted by zinc into isorotenone. Potassium hydroxide fusion of rotenone produces rotenic acid, $C_{12}H_{12}O_4$. The thallium salt $C_{11}H_{11}O_2$ COOTl, has the melting point 203°. The acetyl derivative, $C_{12}H_{11}O_3.O.COCH_3$ has the melting point 155°. Treatment with diazomethane produces an ester which upon saponification leaves an ether acid $C_{12}H_{11}O_3(OCH_3)$ having the melting point 115°. Nitrorotenic acid has the melting point 190°. Methylated nitrorotenic acid, $C_{11}H_9O(NO_2)(OCH_3)COOCH_3$ has the melting point 120°. Decarboxylated rotenic acid, $C_{11}H_{12}O_2$, having a boiling point of 271° and the melting point 42°; and a neutral substance, $C_{22}H_{20}O_4$, result from heating to 300°. The p-toluenesulfonyl derivative of the phenol is $C_{11}H_{11}O\ (OSO_2C_7H_7)$. It melts at 105° to 106°.

Methyl ether phenol has the boiling point 260°. The oxidation of this yields acetic acid.

Oxidation of rotenic acid yields isobutyric acid.

Rotenone is $C_{21}H_{16}O_4(OCH_3)_2$. The phenylhydrazone is $C_{23}H_{22}O_5 : C_6H_8N_2$. It melts at 243°–244°. The oxime, which has a melting point of 239°, is $C_{23}H_{22}O_5 :NOH$. The oxime of isorotenone melts at 230°. Rotenone hydrochloride, melting at 188°, is $C_{23}H_{22}O_6HCl$.

Rotenic acid is apparently isopropyl-hydroxy-coumarone carboxylic acid.

——— (389)

PROCESS FOR PRODUCING A LIQUID INSECTICIDE CONTAINING EFFECTIVE INGREDIENTS OF DERRIS SPECIES. U. S. Patent 1724626, issued August 13, 1929; applied for August 31, 1925; in Japan, September 8, 1924.

Similar to British Patents 239483 (*454*) and 285797 (*455*).

A process of producing a liquid insecticide containing the effective ingredient of the Derris species comprises extracting raw material containing the aforesaid ingre-

TAKEI, S.—Continued.

dient with a volatile organic solvent, mixing the extract with an anhydrous alkali-free fatty material, evaporating the solvent from the mixture, and mixing the resulting product with an aqueous soap solution. For example: (1) A solution of 10 liters of ether and 10 grams of rotenone is added to a mixture of 400 grams of fish oil and 40 grams of hard oil. After being sufficiently agitated, all the ether, or the greater part of it, is recovered by evaporation and condensation, and a semisolid mixture is obtained as a primary material. Five hundred grams of soap are mixed with 100 kilograms of water to prepare a colloidal aqueous solution as a secondary material. In use the primary reagent is mixed with the colloidal aqueous solution, and it may be suitably diluted with 100 kilograms of water when used as an insecticide. The colloidal solution or secondary reagent may be prepared at any time. (2) Ten liters of ether are added to 1 kilogram of the derris root. After four days the extract is added to 400 grams of chrysalis oil and 100 grams of lard. After the ether is evaporated a semisolid substance is obtained as a primary reagent. The preparation of the secondary reagent is similar to that of example 1. (3) Twenty liters of petroleum ether are added to 1 kilogram of derris root. After four days the extract is added to 200 grams of beeswax and 50 grams of pine resin. The larger part of the petroleum ether is then recovered by evaporation and condensation, and the semicolloidal material is obtained as the primary material or reagent. The secondary reagent may be prepared by adding a colloidal solution in which 200 grams of soap are dissolved in 100 kilograms of water.

Rotenone may be extracted with such solvents as methyl alcohol, ethyl alcohol, ether, petroleum ether, chloroform, or carbon tetrachloride. The oils mean all kinds of animal oils, such as sardine oil, herring oil, cod-liver oil, shark oil, chrysalis oil, or a vegetable oil, such as coconut oil, bean oil, rapeseed oil, and castor oil. The fatty oil may be a material such as lard, beef tallow, animal hard oil, and vegetable hard oil. Waxes, such as wood wax, and beeswax may be used, also resins, such as pine resin, and copal.

——— (390)

ÜBER ROTENON. DEN WIRKSAMEN BESTANDTEIL DER DERRISWURZEL. III. DIE MOLEKULARFORMEL DES ROTENONS. Bul. Inst. Phys. and Chem. Research [Tokyo] 8: 369–371. 1929. [In Japanese. Abstract in Abs. from Bul. Inst. Phys. and Chem. Research 2: 48, 1929.]

Molecular weight determinations in benzene and camphor confirm the formula $C_{23}H_{22}O_6$ for rotenone, which is further substantiated by the preparation of a phenylhydrazone and an oxime derivative. It appears that rotenone and isorotenone bear the relation of ethylene cis and trans isomers, since rotenone forms a hydrochloride salt with hydrochloric acid, which is transformed into isorotenone by zinc and glacial acetic acid.

——— and KOIDE, M. (391)

ÜBER ROTENON, DEN WIRKSAMEN BESTANDTEIL DER DERRISWURZEL. V. ÜBER TUBASÄURE. Bul. Inst. Phys. and Chem. Research [Tokyo] 8: 519–524. 1929. [In Japanese. Abstract in Abs. from Bul. Inst. Phys. and Chem. Research 2: 64–66. 1929.]

On boiling with alcoholic potassium hydroxide, rotenone gives an oxy acid having a double bond in the side chain. Kariyone, Kondo, and Makabe called this acid tubaic acid, $C_{12}H_{12}O_4$, and postulated as a formula $C_9H_7\ (CH=CH_2)\ COOH(OH)O$. Takei made a thallium salt and a methyl ester of tubaic acid supporting the $C_{12}H_{12}O_4$ formula. On hydrogenation tubaic acid gives dihydrotubaic acid $C_{12}H_{14}O_4$. Potassium hydroxide fusion of tubaic acid gives isomeric rotenic acid. Dihydrotubaic acid does not do this. Tubaic acid and dihydrotubaic acid rotate polarized light respectively $\alpha^{18°}_{D} = -76.0°$; $\alpha^{20°}_{D} = -82.2°$ in chloroform. Rotenic acid is not active. On oxidation with potassium permanganate tubaic acid gives acetic acid; dihydrotubaic acid gives isobutyric acid. Tubaic acid and dihydrotubaic acid lose carbon dioxide, giving phenols called, respectively, tubanol and dihydrotubanol. This reaction is reversible. Tubanol gives a methyl ester $C_{11}H_{11}\ OOCH_3$, that on oxidation with ozone gives an oil which reduces Fehlings solution and ammonia silver solution when warmed. It gives iodoform reaction and forms p-nitro phenyl hydrazone, melting point 156°, proving a methyl ketone group to be present. Oxidation of tubanol methyl ester with iodine and potassium hydroxide gives $C_{10}H_9IO_4$, melting point 140°. Takei concludes the double bond to be in the β-allyl group. Structural formulae are given which satisfy experimental data.

——— and KOIDE, M. (392)

ÜBER ROTENON. DEN WIRKSAMEN BESTANDTEIL DER DERRISWURZEL. III. ÜBER DIE TUBASÄURE. Ber. Deut. Chem. Gesell. 62: 3030–3034. 1929.

This is the same as *(391)*.

——— KOIDE, M., and MIYAJIMA, S. (393)

ÜBER ROTENON, DEN WIRKSAMEN BESTANDTEIL DER DERRISWURZEL. IV. ISOMERIEVERHÄLTNIS ZWISCHEN ROTENON UND ISOROTENON. Ber. Deut. Chem. Gesell. 63: 508–511. 1930.

Isorotenone is formed when rotenone is boiled in a mixture of acetic and sulphuric acids. When treated with alcoholic potash rotenone gives tubaic acid, and isorotenone gives rotenic acid, an isomer of tubaic acid. Dihydrorotenone does not

TAKEI, S., KOIDE, M., and MIYAJIMA, S.—Continued.

isomerize. Tubaic is isomerized to rotenic acid. These facts show that the isomerism between rotenone and isorotenone is an isomerization of the tubaic acid part in rotenone to the rotenic acid part in isorotenone.

Toxicity tests on fish show that sodium salt of rotenic acid is toxic in a dilution of 0.0005 per cent, sodium salt of dihydrotubaic acid in a dilution of 0.001 per cent, sodium salt of tubaic acid in a dilution of 0.0005 per cent, and rotenone emulsion in a dilution of 0.00001 per cent. Isorotenone is not toxic at a dilution of 0.001 per cent. Dihydrorotenone is toxic in a dilution of 0.0001 per cent, and potassium cyanide in a dilution of 0.0001 per cent.

——— KOIDE, M., and MIYAJIMA, S. (394)

ÜBER ROTENON, DEN WIRKSAMEN BESTANDTEIL DER DERRISWURZEL. V. ÜBER DIE KONSTITUTION DER ROTENSÄURE. Ber. Deut. Chem. Gesell. 63B: 1369–1373. 1930.

Rotenol (the decarboxylated derivative of rotenic acid) on fusion with potassium hydroxide at 270° to 280° gives resorcinol and isobutyric acid. By energetic hydrogenation Butenandt and Hildebrandt converted rotenic acid into the dihydro acid which they resolved into optical antipodes, but they had too little material for comparison as to melting point or optical activity with dihydrotubaic acid. The present authors likewise prepared dihydrorotenic acid by energetic catalytic (platinum) hydrogenation of rotenic acid at 60° in acetic acid, resolved it through the brucine salt, and established its identity with dihydrotubaic acid. The results of the potassium hydroxide fusion and the following color reactions are perhaps an indication of a close relationship between the free hydroxyl group and the coumarone ring of rotenic acid. It is possible that the hydroxyl group occupies the other meta position to the bridge oxygen atom and that the carboxyl group is in the ortho or para position to the hydroxyl group. Of rotenic acid, dihydrorotenic acid, and tubaic acid only rotenic acid has the properties of an orthohydroxybenzoic acid. It gives a deep-blue color with ferric chloride, whereas dihydrorotenic acid and tubaic acid give only a red-violet color. Of the corresponding phenols, only rotenol gives a color (red-violet) with ferric chloride. The methyl ester of rotenic acid boils lower than the methyl ether ester, and both are oils, whereas the methyl esters of dihydrorotenic acid and tubaic acid are crystalline, and the methyl ether esters are oils. The isobutyric acid was identified as the $p{=}IC_6H_4COCH_2$ ester, melting point 81°. Dihydrorotenic acid, melting point 168°, does not depress the melting point of dihydrotubaic acid. The brucine salt, melting point 214° (Butenandt and Hildebrandt give 120° to 150°), likewise does not depress the melting point of the brucine salt of dihydrotubaic acid.

——— KOIDE, M., and MIYAJIMA, S. (395)

ÜBER ROTENON, DEN WIRKSAMEN BESTANDTEIL DER DERRISWURZEL. VI. ISOMERIEVERHÄLTNIS ZWISCHEN ROTENON UND ISOROTENON. Bul. Inst. Phys. and Chem. Research [Tokyo] 9: 1–5. 1930. [In Japanese. Abstract published with Sci. Papers Inst. Phys. and Chem. Research [Tokyo] 12, no. 220, 1930 (Abstract p. 1, separately paged).]

This is the same as Part IV of this series published in Ber. Deut. Chem. Gesell. 63: 508–511, 1930. (*393.*)

——— KOIDE, M., and MIYAJIMA, S. (396)

ÜBER ROTENON, DEN WIRKSAMEN BESTANDTEIL DER DERRISWURZEL. VII. ÜBER DIE KONSTITUTION DER ROTENSÄURE. Bul. Inst. Phys. and Chem. Research [Tokyo] 9: 455–460. 1930. [In Japanese. Abstract published with Sci. Papers Inst. Phys. and Chem. Research [Tokyo] 13, no. 246–253, 1930 (Abstract p. 43–46, separately paged); Chem. Abs. 24: 5756. 1930.]

Rotenic acid was hydrogenated at 60° in acetic acid, and its identity with dihydrotubaic acid was proved by fusion mixtures with the acids and the brucine salts. The brucine salt of dihydrorotenic acid was separated into l and d isomers by extraction. The l isomer had the same specific rotation as dihydrotubaic acid. These facts indicate that rotenic acid is 2-isopropyl-5-hydroxy-4-benzofurancarboxylic acid.

——— and MIYAJIMA, S. (397)

ÜBER ROTENON, DEN WIRKSAMEN BESTANDTEIL DER DERRISWURZEL. IV. ÜBER ROTENSÄURE. Bul. Inst. Phys. and Chem. Research [Tokyo] 8: 510–518. 1929. [In Japanese. Abstract in Abs. from Bul. Inst. Phys. and Chem. Research 2: 64–66. 1929.]

A potassium hydroxide fusion of tubaic acid $C_{12}H_{12}O_4$ gives a phenolic acid called rotenic acid, $C_{12}H_{12}O_4$. Rotenic acid gives a thallium salt, an acetyl, and a dimethyl derivative. When distilled rotenic acid gives a phenol $C_{11}H_{11}OOH$ called rotenol. Rotenol gives an oily methyl ether which gives rotenol with aluminum chloride. The position of the fourth oxygen in rotenic acid is not known. Rotenic acid on oxidation with potassium permanganate gives isobutyric acid, but rotenol methyl ether gives acetic acid. Takei postulates rotenic acid as an isopropyl-oxy-coumarone-carboxylic acid in which the positions of the substituents are not known, but concludes that the isopropyl group is attached to the benzene ring. Attempts at synthesis failed, probably because of polymerization.

Takei, S., Miyajima, S. and Ono, M. (398)

ÜBER ROTENON, DEN WIRKSAMEN BESTANDTEIL DER DERRISWURZEL. VI. MITTEILS DIE KONSTITUTION DER DERRISÄURE UND RISSÄURE. Ber. Deut. Chem. Gesell. 64: 248–252. 1931.

Rissic acid is prepared by permanganate oxidation of derrisic acid and is the next lower homologue of derric acid. When heated rissic acid loses carbon dioxide, forming a monobasic acid. This acid and rissic acid, when treated with nitric acid, give a dimethoxy nitro benzoic acid. On fusing with alkali rissic acid gives hydroquinone. The authors conclude that derric acid is 2, 5 dimethoxy phenyl succinic acid.

Tamanuki, K. (399)

STUDIES ON GALERUCELLA RUBI, TAMANUKI, SP. N. Dept. Agr. and Foreign Govt. Sakhalin Research Bul. 1, p. 1–19. 1928. [In Japanese. Abstract in Rev. Appl. Ent. (A) 16: 604–605, 1928.]

In southern Sakhalin *Galerucella rubi,* sp. n. infests the young leaves of strawberry plants in both the larval and adult stages. Spraying with a soap solution alone or mixed with derris is recommended for control.

——— (400)

STUDIES ON LUPERODES PRAEUSTUS MOTSCH—PRELIMINARY REPORT. Karafuto Agr. Expt. Sta. Rpt., 24 p., illus. 1929. [In Japanese. Abstract in Rev. Appl. Ent. (A) 17: 706. 1929.]

Spraying with derris is recommended to control the larvae of *Luperodes praeustus* Motsch.

Tanaka, K. (401)

ON DRYMONIA MANLEYI, LEECH. Insect World 31: 218–225. 1927. [In Japanese. Abstract in Rev. Appl. Ent. (A) 15: 492. 1927.]

This Notodontid eats the leaves of oak trees, causing serious damage. Spraying the older larvae with derris and soap solutions is recommended as a control measure.

Tattersfield, F. (402)

FISH POISONS AS INSECTICIDES. Nature [London] 116: 243. 1925.

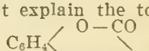
Different species of derris yield extracts having insecticidal action of a high order. A lactone structure has been suggested for the poisons from *Derris elliptica* and *Tephrosia vogelii.* Extracts from black and white haiari from British Guiana are highly poisonous to aphids.

——— (403)

THE RELATIONSHIP BETWEEN THE CHEMICAL CONSTITUTION OF ORGANIC COMPOUNDS AND THEIR TOXICITY TO INSECTS. Jour. Agr. Sci. [England] 17: 181–208. 1927.

In *Derris elliptica* the characteristic poison to insects is a colorless crystalline substance, first isolated in a pure state by Ishikawa in 1916, to which was given the name tubatoxin. Tubatoxin is one of the most potent insecticides so far discovered and is more widely distributed than was at first suspected. In addition to its occurrence as a constituent of derris, it has been recently shown to be present in considerable quantities in two species of plants of the genus Lonchocarpus, indigenous to British Guiana. They are known to aborigines as white and black haiari, and are used for catching fish in a way very similar to the one in which derris is employed by the Malays.

In derris, tubatoxin is accompanied by a resin (derrid) present in some samples in considerable quantities and showing insecticidal properties of a high order, whereas in the samples of haiari so far examined resinous material was present in smaller amounts and was found somewhat less toxic than tubatoxin. There is considerable difficulty in freeing the resinous material from the last traces of tubatoxin, to which some of its toxic properties may be due. In addition to tubatoxin, a yellow crystalline derivative has been isolated from derris. It was, however, subsequently noted that a series of yellow crystalline and nontoxic compounds could be prepared from tubatoxin by prolonged treatment with alcohol, and it is therefore highly probable that the yellow crystals were secondary products of the extraction process. Tubatoxin crystallizes either in hexagonal plates or needles. It melts at 163.5° C., and the formula $C_{18}H_{18}O_5$ has been ascribed to it by Ishikawa, and by Kariyone and Atsumi, but $C_{19}H_{18}O_5$ is considered as more probable by Takei. Takei states that 1.5 methoxy groups and 1 carboxyl group are present in the molecule. Saponification with 3 per cent hot alcoholic potash gives a phenol carboxylic acid having the melting point 128° to 129° C.

It has been suggested by Priess that a lactone structure might explain the toxic properties of such compounds to fish. The lactone coumarin  $C_6H_4\left\langle\begin{array}{l}O-CO\\ CH=CH\end{array}\right.$ has been shown by Ellinger to have definite narcotic properties. Some experiments on its insecticidal value showed that at a concentration of 0.25 per cent it is almost completely toxic to *Aphis rumicis.* Too little, however, is known at present of the constitution of tubatoxin to more than suggest that a lactone structure accounts for its toxic action. It is, moreover, many times more toxic to insects than coumarin (p. 186–187).

Tattersfield, F., Gimingham, C. T., and Morris, H. M. (404)

STUDIES ON CONTACT INSECTICIDES. PART IV. A QUANTITATIVE EXAMINATION OF THE TOXICITY OF CERTAIN PLANTS AND PLANT PRODUCTS TO APHIS RUMICIS, L. (THE BEAN APHIS). Ann. Appl. Biol. 13: 424–445. 1926.

The most toxic substance obtained from the roots and stems of white haiari and the stems of black haiari (both species of Lonchocarpus from British Guiana) is identical with tubatoxin, the crystalline poison found in *Derris elliptica*. This was shown by the melting point of the crystals (162.5° to 163.5°) and the curves recording the toxicity to *Aphis rumicis*.

——— and Roach, W. A. (405)

THE CHEMICAL PROPERTIES OF DERRIS ELLIPTICA (TUBA ROOT). Ann. Appl. Biol. 10: 1–17. 1923.

The toxic principles of *Derris elliptica* have been isolated, and some of their more simple properties examined. A chemical method for evaluating the root is outlined, and a suitable extraction apparatus described. The most important constituents of the root are a white crystalline derivative usually called tubatoxin and a resin or series of resins identical with the derride of Sillevoldt and the tubain of Wray. Besides these two, yellow crystalline derivatives and a liquid resin were isolated. Tubatoxin, the yellow crystalline derivatives, and the resins contain methoxyl groups, and these compounds appear to be interrelated. By exposure to light, and by prolonged boiling with organic solvents tubatoxin is converted into three yellow crystalline products and a resin. This suggests that the anhydroderride of Sillevoldt (*366*) may have been formed during the process of extraction and may not exist as such in the root.

The poisons from the root are readily extracted by means of organic solvents. Ninety-five per cent alcohol extracts them, together with nontoxic derivatives. Benzene, dry ether, and carbon tetrachloride are also good solvents for extraction purposes and have a selective dissolving action on the poisons. Petroleum derivatives are not suitable for complete extraction. Prolonged boiling with solvents may cause some loss of toxicity in the extracts, owing to chemical change in the tubatoxin. For economic purposes benzene and its congeners or alcohol are probably the most suitable extraction reagents, provided the temperature of extraction is not allowed to rise too high.

The root may be evaluated by chemical means by extracting the dry root with dry ether. The genuineness of the extracts may be confirmed by the determination of the methoxyl content by the Zeisel method. Extracts from different deliveries varied between 7 and 22 per cent and the content of (CH_3O) in the extracts between 13.5 and 14.7 per cent. A qualitative test for tubatoxin devised by Doctor Durham is outlined on page 5.

The amounts of the nontoxic constituents vary widely in different consignments. They seem to have some value as emulsifying and wetting agents. As the root, however, arrives in this country in a dry state in which the constituents have probably coalesced, the use of foreign emulsifying and wetting reagents is necessary, and for maximum efficiency the use of organic solvents for preparing highly dispersed suspensoids appears advisable.

The authors isolated from the alcohol extract of the roots: Yellow crystals (I) melting at 214° C.; yellow crystals (II) decomposing at 280°; tubatoxin, which on boiling with alcohol, etc., yielded yellow crystals (I) and (II), and also yellow crystals (III) with a melting point of 224°, and resin.

"After the work for this paper had been completed, we were favored with notes on investigations carried out between 1902 and 1907 by Dr. H. E. Durham. For commercial reasons his results have not been published. In general, Durham's conclusions in regard to the insecticidal properties of Derris are concordant with ours. Thus larvae of Lepidoptera and sawflies are very susceptible, and aphids (bean aphis, *A. rumicis* and woolly aphis. *E. lanigera*) are quite resistant to wet application. Mosquito larvae and pupae, fresh water crustaceans and molluscs, also tadpoles and fish formed susceptible test animals. Durham insists on the existence of the active principles in a crystalline and resinous form and states that the former is best obtained from the original petrol ether extract freed from resin first by cold absolute alcohol and then repeated crystallizations from the same solvent heated, until the laminar acicular crystals with the constant melting point 164½° C. are obtained. Both these active principles give (notice the impossibility of getting a crystal-free resin) a characteristic and intense red color reaction with strong nitric acid which contact with a drop of ammonia changes to an evanescent deep peacock blue-green. Tests for nitrogen, sulphur, glucosides and cholesterols (v. Power) prove negative. As regards insects Durham concludes that toxic effects are due to absorption from the alimentary canal rather than from surface contact."

Teijsmann. (406)

NATUURK. TIJDSCHR. NEDERLAND.-INDIA. 16: 20–21. 1857.

In a letter from Mr. Teijsmann dated September 18, 1857, the use of akar tuba as a fish poison in Java is mentioned.

Tempany, H. A. (407)

DEPARTMENT OF AGRICULTURE, FEDERATED MALAY STATES, ANNUAL REPORT FOR THE YEAR 1928. 17 p. 1929.

In the Federated Malay States the area planted to tuba (*Derris elliptica* or tuba puteh and *D. malaccensis* or tuba merah) remains at about 700 acres, but that in Johore is estimated to have increased from 1,400 to 2,000 acres. Reference is made to the work of Georgi (*132*) in determining the toxic value of different varieties of derris root and the variation of toxic content with age (p. 9, 17).

TEMPANY, H. A.—Continued. (408)

DEPARTMENT OF AGRICULTURE, FEDERATED MALAY STATES, ANNUAL REPORT FOR THE YEAR 1929. 19 p. 1930.

Insect pests of derris have been investigated (p. 14).

THOMPSON, A. (409)

ANNUAL REPORT OF THE MYCOLOGIST FOR 1923. Malayan Agr. Jour. 12: 250. 1924.

Pink disease (*Corticium salmonicolor*) is recorded as attacking the stems of this plant (*Derris elliptica*).

THOMPSON, H. W. (410)

FURTHER TESTS OF POISON BAITS IN SOUTH WALES. Welsh Jour. Agr. 4: 342–347. 1928.

Copper sulphate, derris powder, and sodium fluosilicate were tried in poison baits against leatherjackets. Derris powder, although it did not give as good results as the Paris green bait, is obviously of definite insecticidal value when used in this way. On this plot numerous earthworms were found lying dead on the surface and also some slugs. Derris powder clearly does not render the bait distasteful to the pests named, as appeared to be the case with sodium fluosilicate. The derris bait was composed of 10 pounds of bran and half a pound of derris powder distributed over half an acre of oats. The author concludes that derris powder gives moderately good results.

THWAITES, G. H. K., and HOOKER, J. D. (411)

ENUMERATIO PLANTARUM ZEYLANIAE: AN ENUMERATION OF CEYLON PLANTS, WITH DESCRIPTIONS OF THE NEW AND LITTLE KNOWN GENERA AND SPECIES, OBSERVATIONS ON THEIR HABITATS, USES, NATIVE NAMES, ETC. 483 p. London. 1864.

Derris uliginosa occurs in the hotter parts of Ceylon (p. 92).

TOWNSEND, O. C. (412)

CUBE USED AS AN INSECTICIDE IN PERU. U. S. Dept. Com. Bur. Foreign and Dom. Com. World Trade Notes on Chemicals and Allied Products 3(24): 9–10. 1929.

Cube is either *Tephrosia piscatoria* or *T. cinerea*. It is used in Peru as a wash for killing parasites, such as ticks on cattle and the insects on cacao leaves.

[Killip and Smith (227) have shown cube to be *Lonchocarpus nicou* and Clark (74) has shown it to contain rotenone.]

TREHERNE, R. C. (413)

BIO-CHEMICAL ASPECTS OF INSECT CONTROL. Sci. Agr. 3: 109–113. 1922.

It might be possible as a result of the separation of the essential oils or extracts of plants to prepare liquid sprays or medicated powders which would have a negative chemotropical action on our so-called insect pests. It is being done with tobacco, pyrethrum, hellebore, derris, and certain other substances, and there is no reason why the future should not develop methods of combating insects along physiological lines.

TRIMEN, H. (414)

A HAND-BOOK TO THE FLORA OF CEYLON. Pt. 2, 392 p. London. 1894.

Describes six species of Derris, including *uliginosa,* found in Ceylon (p. 91–94).

TWINN, C. R. (415)

MOSQUITO CONTROL AT OTTAWA, ONTARIO. Ontario Ent. Soc. Ann. Rpt. 57. 63 p., illus. 1927.

Tests with derris powder upon mosquito larvae and pupae in the laboratory are described. The derris was dusted on the water surface at the rate of approximately 3 pounds per acre. The larvae died within periods ranging from three-quarters of an hour to more than seven hours. In all cases the larvae, before death,, became very feeble, lying motionless and parallel with the surface of the water, moving with difficulty when rudely disturbed. The pupae died more slowly than the larvae, more than 24 hours sometimes elapsing before death occurred.

Tests were also made upon a shallow pool about 200 square feet, with a grass-grown bottom. This pool contained large numbers of larvae of *Aedes vexans* Mgn. A mixture of derris and French chalk in the proportion of 1 part of the former to 4 of the latter was dusted just before sundown on the surface of the water by means of a small hand dust gun, at the rate of 1½ pounds of derris to the acre. The material settled well, forming a very satisfactory film of dust over the entire surface. When examined 16 hours later, a considerable proportion of the larvae were dead and many of the living revealed the effects of the derris in their sluggish movements. The pool was not examined again until 60 hours after treatment. On this occasion all the larvae were dead, many floating on the surface of the water (p. 15–16).

UNITED STATES DEPARTMENT OF AGRICULTURE. (416)

CUBE ROOT IS FATAL TO THE CATTLE GRUBS. U. S. Dept. Agr. Clip Sheet 621. May 25, 1930.

Describes tests for the control of cattle grubs made by Federal entomologists. The derris and cube-root powders had no unfavorable effect on the skin and hair of the animals. These materials are not particularly poisonous and hence are very safe to use. Applications of these powders at 15-day intervals killed most of the grubs. Two to four treatments were required.

——— (417)

W. W. SKINNER TO HELP REHABILITATE AGRICULTURE IN THE VIRGIN ISLANDS. U. S. Dept. Agr., Off. Rec. 10: 92. 1931.

Refers to the trip of W. W. Skinner to the Virgin Islands to investigate the possibilities of growing such insecticidal plants as pyrethrum, derris, and cube, and the extraction from these plants of valuable insecticidal materials.

UNITED STATES DEPARTMENT OF COMMERCE, BUREAU OF FOREIGN AND DOMESTIC COMMERCE. (418)

CUBE (BARBASCO) A BOTANICAL INSECTICIDE. U. S. Dept. Com., Bur. Foreign and Dom. Com., World Trade Notes on Chemicals and Allied Products 4 (20) : 11–12. 1930.

The principal collector of cube, located in Lima, Peru, has informed Commercial Attaché C. H. Cunningham that he is able to execute regular orders for dry cube at the price of $550 to $600 per ton f. o. b. Iquitos, according to its dryness. The latter price is for cube entirely dry, which is preferred because it does not lose weight and deteriorates less while en route. It takes four weeks to dry cube properly, after which it can be shipped by the first outgoing vessel.

Samples of this drug plant have been forwarded to the United States during the last few months, but no really important commercial shipment has so far taken place.

——— (419)

DERRIS (TUBA ROOT) AVAILABLE IN BOTH SINGAPORE AND BATAVIA. U. S. Dept. Com., Bur. Foreign and Dom. Com., World Trade Notes on Chemical and Allied Products 4 (44) : 10. 1930.

Contrary to the popular belief that the export of derris (tuba) root in Singapore is controlled by the representative of a British firm, who, it is said, ships approximately 200 tons of dried root per month, another Singapore firm exporting native products claims to have made trial shipments to American firms for experimental purposes and to be in a position to furnish derris root to American importers of crude botanical drugs and manufacturers of insecticides.

Furthermore, a contact of the bureau's Batavia office who recently sold an American firm more than 1,000 pounds at an average price of $0.30 per pound states that he expects in a year to have a steady source and to be in a position to supply American importers. (Trade Commissioners, Singapore and Batavia.)

V., P. (420)

INSECTICIDES VEGETAUX D' EXTREME-ORIENT (DERRIS ELLIPTICA ET D. ULIGINOSA). Bul. Ècon. Indochine 27 : 255–257. 1924.

Reviews work of McIndoo, Sievers, and Abbott, and report of British Empire Exhibition, London, 1924, Malayan series, Nos. 2, 8, and 19.

VAN BLARCOM, H. P. (421)

AUSTRALIAN MANUFACTURE OF NICOTINE SULPHATE. U. S. Dept. Com., Bur. Foreign and Dom. Com., World Trade Notes on Chemicals and Allied Products 5 (2) : 3. 1931.

Nicotine and derris spraying preparations valued at £13,700 were imported into Australia during 1928–29.

VAN BUREN, B. D. (422)

QUESTIONS SENT IN BY GROWERS WITH ANSWERS AND DISCUSSIONS. N. Y. Hort. Soc. Proc. Ann. Meeting 73. 1928.

In reply to the question, "Is there any substitute for nicotine in the control of aphis and pear psylla?" it is stated that Derrisol is quite effective.

In reply to the question, "Is Derrisol a satisfactory substitute for nicotine when used for rosy aphis control," Doctor Parrott replied: "Used at the rate of 1 gallon to 800 United States gallons of water, we got about 8 per cent rosy aphis on our Rome trees as against a little less than 1 per cent on plats sprayed with lime-sulphur and nicotine sulphate. For the present, I would rather stick to the nicotine sulphate, which is more dependable, at least in the proportion used. It is, however, a promising poison."

In reply to the question, "Is Derrisol as efficient and as satisfactory a material for aphids and red bugs as Blackleaf 40," Mr. Mundinger replied, "I have no information on the subject. I have never used it" (p. 283–285).

VORDERMANN, A. G. (423)

VERSLAG VAN EEN TOCHT NAAR DE WIJNKOOPERSBAAI IN JUNI 1885. Natuurk. Tijdschr. Nederland. Indië 49: 225–298. 1890.

Speaks of tuba as a fish poison (p. 288).

WALLICH, N. (424)

PLANTAE ASIATICAE RARIORES; OR DESCRIPTIONS AND FIGURES OF A SELECT NUMBER OF UNPUBLISHED EAST INDIAN PLANTS. v. 3, 300 p., illus. London. 1832.

Gives a botanical description in Latin, and a drawing of the flower, leaf, legume, and seed of *Pongamia elliptica* (*Derris elliptica*).

WALTON, C. L. (425)

NOTES ON WARBLE FLIES IN NORTH WALES. Welsh Jour. Agr. 1: 195–199. 1925.

Some preliminary experiments were tried, with an ointment of powdered derris root and soft paraffin. Derris is a cheaper substance than iodoform and odorless. The results obtained with 91 cattle were most promising.

——— (426)

FURTHER NOTES ON WARBLE FLIES IN NORTH WALES. Welsh Jour. Agr. 3: 164–169. 1927.

The killing properties of derris appear to be excellent. The ointment is odorless, and the cost is low—about 2½ pence per ounce, in experimental amounts. On the other hand. the ointment was found to be much more difficult to apply, and olive oil was utilized, the ointment then consisting of 1 part powdered derris, 1 part soft paraffin, and 1 part olive oil. This improved the texture and rendered application easier. Another important point found was that the larvae did not leave the hide so readily after death, but remained within the hide, together with some pus, healing being delayed. In numerous cases it was very difficult to tell by external appearances whether warbles treated a month previously were dead or not, but on slight pressure being applied a dead larva, together with some pus, could be extracted. A few remained even six weeks after death. This is a disadvantage. Stewart MacDougall (*273*) obtained excellent results with derris as a fluid, 1 ounce to a pint of water, effecting a control of 94 per cent (p. 168).

WARDLE, R. A., and BUCKLE, P. (427)

THE PRINCIPLES OF INSECT CONTROL. 295 p. Manchester. 1923.

Derris is the name applied to Deguelia, the tropical genus of Papilionaceae, the roots of which have long been used as a fish poison, the toxic principle being probably a resin. The raw material is in the form of roots or bark of a plant termed in Borneo "tuba ralut," "tuba tedong," or "perkakal," ground to powder and extracted with water. It is an effective stomach poison at strength ranging from 1 pound of powder to 16 to 28 imperial gallons of water. As a contact poison, with or without soap, it is effective against aphids, even if diluted as much as 1 pound to 400 imperial gallons of water. It is the basis of several proprietary combination insecticides.

A wash consisting of 1 pound of derris and 4 ounces of soap to 1 United States gallon of water is recommended by Wells, Bishopp, and Laake (*433*) for application to the backs of cattle infected with warble fly (Hypoderma). It is claimed to kill all the larvae in the swellings. It has been used successfully also as a powder, mixed with an equal weight of maize starch, against Anoplura, Mallophaga, and fleas on domestic animals, but for this purpose seems somewhat inferior to sodium fluoride (p. 98).

WATANBDE, T. (428)

A CONTROL METHOD FOR HELLULA UNDALIS FAB. (PYRALIDAE), A PEST OF VEGETABLES. Agr. and Hort. 2: 987–992. 1927. [In Japanese. Abstract in Rev. Appl. Ent. (A) 15: 641. 1927.]

Spraying the young growth of cruciferous vegetables with derris, nicotine sulphate, pyrethrum, or lead arsenate is recommended.

WATSON, J. R. (429)

ANOTHER YEAR OF THE CITRUS APHIS (APHIS SPIRAECOLA, PROBABLY IDENTICAL WITH APHIS POMI). Fla. Ent. 9: 9–13, 26–28. 1925.

The two methods of control which have been most uniformly successful under most weather conditions are dipping and dusting under tents or fumigation. Dipping is applicable only to young trees, up to two or three years, and then only when the new growth is mostly out on the ends of the branches, where it can easily be bent over into a bucket. Effective and perfectly safe dips are a solution of "derris oil," a tablespoonful to a gallon of water, or the same amount of nicotine sulphate plus an ounce or less of soap. If too much soap is used burning may result (p. 12).

WATSON, J. R.—Continued. (430)

REPORT OF THE ENTOMOLOGIST. Fla. Agr. Expt. Sta. Ann. Rpt. 1926: 42R–50R. 1926.

Derrisol was tried out against the new citrus aphid, *Aphis spiraecola* Patch, in comparison with nicotine sulphate. Its action is much slower, but it seems to have a repellent effect for a day or two. It may not penetrate the curled leaves quite so well as nicotine sulphate (p. 43R).

——— (431)

REPORT OF THE ENTOMOLOGIST. Fla. Agr. Expt. Sta. Ann. Rpt. 1927, 43R–49R. 1927.

A heavy infestation of the Florida flower thrips, *Frankliniella tritici bispinosa* Morgan, on strawberry blossoms afforded an opportunity to try out various insecticides. Derrisol (1 : 800) was an almost complete failure, only about 10 per cent of the insects being killed. Nicotine sulphate spray (1 : 800) killed nearly 90 per cent. Even better results were obtained by dusting the plants with a mixture of equal parts of sulphur and finely ground tobacco (snuff No. 2) analyzing 2 per cent nicotine. This not only killed the thrips in the blossoms but acted as a repellent and delayed reinfestation for several days (p. 46–R).

WATT, G. (432)

A DICTIONARY OF THE ECONOMIC PRODUCTS OF INDIA. v. 3, 534 p. London and Calcutta. 1890.

Describes three species of Derris found in India, including *Derris elliptica* (p. 80–81).

WELLS, R. W., BISHOPP, F. C., and LAAKE, E. W. (433)

DERRIS AS A PROMISING INSECTICIDE. Jour. Econ. Ent. 15: 90–96. 1922.

The powdered derris root used in these tests was supplied by the Tobacco By-Products & Chemical Corporation and was supposed to be from *Derris elliptica*. Tests were made upon chickens infested with seven species of lice and cattle infested with the common biting louse of that host (*Trichodectes scalaris*). Fowls were also dipped in a bath containing one-fourth ounce of powdered derris to 1 gallon of water and also in a bath containing 1 ounce of derris to 3 gallons of water. Calves were dusted with a mixture of equal parts derris and tobacco dust, the latter containing about 0.1 per cent nicotine. This gave satisfactory results, but a mixture of 1 part derris to 10 parts tobacco dust gave unsatisfactory results. One part derris to from 3 to 20 parts wheat flour killed nearly all the lice. Tests were also made against two of the common sucking lice of cattle, namely, *Linognathus vituli* L. and *Solenopotes capillatus* End., upon calves moderately infested with *S. capillatus*, and on dogs heavily infested with the sucking louse, *Linognathus setosus* Olfers. An ointment consisting of 1 part derris to 2 parts vaseline was very effective when applied to the holes of warbles in the backs of cattle. All grubs were killed by a wash consisting of 1 pound derris, 4 ounces soap, and 1 gallon water. Derris powder was also very effective against dog and cat fleas (*Ctenocephalus canis* and *Ct. felis*), and sticktight flea (*Echidnophaga gallinacea*). Sticktight fleas on puppies were killed with derris powder.

The authors' conclusions are as follows: "Derris powder is satisfactory as a destroyer of Mallophaga on chickens and cattle, but apparently not quite so effective on the latter as is sodium fluoride. It is very effective against Anoplura on cattle and dogs, one treatment destroying the pest at all stages. The results of its use against fleas on dogs and cats are probably most striking, very small amounts being sufficient to destroy all fleas present. It appears to be effective for lice and fleas when reduced with from 1 to 10 parts of a carrier to 1 part of derris."

WEST VIRGINIA DEPARTMENT OF AGRICULTURE. (434)

DIVISION OF PLANT DISEASE AND INSECT CONTROL. W. Va. Dept. Agr. Bien. Rpt. 8: 30–49. 1927–28.

Derrisol showed promising results as a repellent and killing agent for adult Mexican bean beetles and as a killing agent for larvae. This was tested in contrast with nicotine sulphate. The nicotine showed no killing powers whatever, but the Derrisol did seem to kill.

WESTERMAN, W. (435)

DE TABAKSCULTUUR OP SUMATRA'S OOSTKUST. 300 p., illus. Amsterdam. 1901.

If tobacco lice are noticed on only one or a few plants, these plants should be pulled and burned. One must, moreover, spray the surrounding tobacco plants with a solution of derris roots (p. 164).

WHITCOMB, W. D. (436)

OBSERVATIONS ON THE CARROT RUST FLY (PSILA ROSAE FAB.). Jour. Econ. Ent. 22: 672–675. 1929.

Preliminary experiments with several insecticides showed promising results with derris compounds, corrosive sublimate, and sodium fluosilicate against the first generation of the carrot rust fly.

In the laboratory all flies confined with potted carrots which had been dusted with powdered derris root died in less than 24 hours. The insecticide was as effective three days after it was applied as when fresh, and when diluted one-fourth and one-half with gypsum killed the flies as readily as the pure dust.

WHITCOMB, W. D.—Continued.

In the field the pure powdered derris root gave 87 per cent protection after treatments with a hand duster on June 16, 23, and July 2. The untreated plot suffered 78 per cent injury. Derris-gypsum dust, Derrisol spray, sodium fluosilicate spray, and corrosive sublimate solution gave 70 per cent or more protection under the same conditions. Similar treatments on August 21 and 29 were not so effective against the late brood of maggots when applied under less favorable conditions.

WIGHT, R. (437)

ILLUSTRATIONS OF INDIAN BOTANY; PRINCIPALLY OF THE SOUTHERN PARTS OF THE PENINSULA. Botanical Miscellany (Hooker), v. 3, 385 p., illus. London. 1833.

A drawing and botanical description of *Pongamia religiosa* (*Derris uliginosa*) from India (p. 301–302).

——— (438)

ICONES PLANTARUM INDIAE ORIENTALIS. v. 2, 735 p., illus. Madras. 1843.

Gives a drawing and botanical description of *Pongamia elliptica* (*Derris elliptica*) from India.

——— and WALKER-ARNOTT, G. A. (439)

PRODROMUS FLORAE PENINSULAE INDIAE ORIENTALIS. v. 1, 480 p. London. 1834.

A botanical description of five species of Pongamia, including *P. uliginosa* (*Derris uliginosa*) from India (p. 262–266).

WILKINSON, D. C. (440)

A REVISION OF THE INDO-AUSTRALIAN SPECIES OF THE GENUS APANTELES (HYM. BRACON). PARTS I–II. Bul. Ent. Research, 19 (pts. 1–2): 79–105, 109–146, illus. 1928.

Apanteles hasorae, sp. n., has as its host the Hesperiid, *Hasora mixta*, Mab., on derris (p. 134).

WILLAUME, F. (441)

LES DONNEES ACTUELLÉS SUR LES VEGETAUX INSECTICIDES. Ann. Epiphyties 9: 431–441. 1923. [Abstract in Rev. Appl. Ent. (A) 13: 153, 1925.]

A review of the work of McIndoo and Sievers, and others on the use of various plants (tobacco, pyrethrum, derris, etc.) as insecticides. Additional tests of the insecticidal action of plants should be made.

——— (442)

UTILIZATION DES PROPRIÉTÉS INSECTICIDES DU DERRIS. Rev. Hist. Nat. Appl. 6 (Pt. 1): 285–288. 1925.

A review of the work of McIndoo, Sievers, and Abbott, Tattersfield and Roach, and others.

WILLIAMS, C. G. (443)

REPORT OF THE DIRECTOR. Ohio Agr. Expt. Sta. Ann. Rpt. 41, 52 p., illus. 1922.

The following tests were made with derris products for aphid control: A block of badly infested Spirea Van Houttii was sprayed one-half with Derrisine (1–1,200) and one-half with nicotine sulphate, 1 teaspoonful to the gallon of soapsuds. An examination showed that 80 per cent of the aphids were killed by the Derrisine and 95 per cent by the nicotine solution. Dipping tests gave about the same proportions of killing effect. So far these experiments have not shown that Derrisine has aphicide properties equal to that of nicotine sulphate, and it is not much cheaper, if any.

Similar experiments were made to compare Derrisine products with sodium fluoride for the destruction of hen lice. Both remedies seemed to kill all the lice without perceptible injury to the hens, but the action of the Derris preparation was considerably slower than that of sodium fluoride (p. 31).

———

THRIPS IN GREENHOUSES. Ohio Agr. Expt. Sta. Ann. Rpt. 46 (Bul. 417): 50. 1928.

Derrisol used at the rate of 1 to 400 gave 97 per cent control of onion thrips (*Thrips tabaci* Lind.) in greenhouses.

WILSON, G. F. (445)

CONTRIBUTIONS FROM THE WISLEY LABORATORY. LIII. THE RHODODENDRON WHITE FLY. Jour. Roy. Hort. Soc. 54: 214–217. 1929.

Nymphs of the white fly, *Dialeurodes chittendeni*, were found infesting leaves of *Rhododendron jacksoni* and *Rhododendron ponticum*. The most satisfactory method of controlling this pest in plantations and shrubberies and on specimen plants is to spray the lower surfaces of the foliage, not neglecting the older leaves, with a highly refined emulsified oil which has proved thoroughly effective against white fly. It was

WILSON, G. F.—Continued.

found that when such an oil was used at 2 per cent strength, complete control was effected. It is essential that the larvae and pupae should be wet by the wash, which must be applied at a pressure of at least 90 pounds to the square inch. This pressure may be readily attained by using a pneumatic knapsack sprayer. Washes containing nicotine and derris were found to be less toxic to the insects in the immature stages.

WINDAUS, A., and BUTENANDT, A. (446)

UNTERSUCHUNGEN ÜBER DAS ROTENON, DEN PHYSIOLOGISCH WIRKSAMEN BESTANDTEIL DER DERRIS ELLIPTICA. Nachr. Gesell. Wiss. [Göttingen] Heft 1: 1–8. 1928.

A discussion of the results obtained by Butenandt (*64*).

WINSTON, J. R. (447)

DERRISOL, A NEW APHID SPRAY. Citrus Indus. 7 (3) : 32. 1926.

Derrisol, a proprietary preparation of derris, should be diluted 1 to 800 with water. It is effective against aphids and thrips, will not injure delicate foliage, and is stated to be nonpoisonous to man. In England it is extensively used against the hop aphis. Should a grower be spraying with lime and sulphur solution for rust mites, oil emulsion for scale, Bordeaux mixture for fungous diseases, or arsenate of lead for chewing insects, and any aphids are present, an addition of Derrisol 1 to 800 will pay handsomely, controlling this pest with one spraying. If aphids are present and no other application is to be made, Derrisol mixed with water without soap will be the cheapest efficient liquid aphicide that can be applied.

WOOD, W. L. (448)

TUBA ROOT. Fed. Malay States Dept. Agr. Bul. 1: 164–166. 1912.

" During the early part of the year the cabbage on Maxwell's Hill was partly destroyed by small caterpillars of about three species which have not yet been determined. The usual emulsion of kerosene and soft soap did very little good, and when sprayed frequently, brought about scorch. A solution made from tuba root was next tried, and after several applications, it was seen that the new leaves appearing were free from holes and the plant was temporarily free from the pest. Tuba root is made up in bundles weighing about 1½ katties (2 pounds), and is sold in most markets in the Federated Malay States for 40 cents (Malayan currency). The strength of the solution used for the cabbage was as follows: One bundle, first crushed by beating, was added to 2 [imperial] gallons of boiling water, and a few hours were allowed for soaking. The water then presented a milky appearance. This may be called the stock solution. For spraying, 1 quart of this was added to 2 [imperial] gallons of water, and the whole well churned. Spraying was done usually after sunset. The heavy rains on Maxwell's Hill necessitated frequent usage, and the spray had to be used again the following morning if rain fell during the night. Unlike the kerosene emulsion no scorch was seen after bright sunshine. By persistent spraying the cabbage can easily be rid of the caterpillar pest with no apparent damage or retarding of growth. A 40-cent bundle will make 16 [imperial] gallons of an effective insecticide, sufficient to spray a quarter of an acre of cabbage.

"A further trial was carried out on a bed of germinating celery. About a week after planting the seed, a colony of ants took up their abode in the bed, working channels and mounds and doing much damage. The tuba root solution was applied in the same proportions as was used for cabbage; it was poured over by a watering-can, and the soil was well saturated. A few hours afterwards not an ant could be seen. It was expected that the seedlings which were just pushing their way through the soil would have suffered from the solution, but no apparent damage or retarding of growth was noticed. Although the proportions used were not sufficiently strong to cause death among the ants, the solution appeared to bring about migration.

" Tuba root solution compares very favorably with chemically prepared insecticides, since it can be used for spraying the tenderest of leaves and seedlings, and for saturating the soil under standing crops with no apparent damage to either roots or leaves. Its cheapness and effective properties should make this plant more widely known and used. To export the solution in a concentrated form would possibly be a profitable business. Its use in English orchards against codling moth and gooseberry maggot would be well worth a trial. Another use to which it may be put is for bathing dogs, 1 quart of stock solution to 1 gallon of water. It readily kills fleas and ticks and does not irritate the skin, except when the dog has mange. Then on no account should it be used.

" In purchasing tuba roots from the markets it is well to break open the bundle. The interior is often filled with rubbishy fibrous roots and plenty of soil to make weight while the outside is neatly arranged with long and useful looking roots. One more point to observe is the freshness; when old, the strength of the solution is reduced to a great extent. The name proper is unknown to the Chinese in the markets, and often difficulty is experienced in making them understand what is wanted. The Malay name is tuba and invariably reaches home.

"(The tuba plant is grown by Chinese in vegetable gardens and can be bought in the market of Kuala Lumpur where it has been sold recently in large quantity. It is extensively used by Chinese in vegetable gardens, not only as an insectifuge but also to keep cows and goats from eating the vegetables. The plant provides also the well-known fish poison. Ed.)"

WOODS, A. F. (449)

THE RELATION OF SCIENTIFIC RESEARCH TO AGRICULTURAL PROGRESS. Science (n. s.) 72: 563–566. 1930.

Refers to rotenone as a valuable contact and stomach insecticide that is not poisonous to warm-blooded animals.

WORTHLEY, H. N. (450)

REPORT THIRD ANNUAL CONFERENCE ON EUROPEAN CORN BORER RESEARCH, WASHINGTON, D. C. 23 p. 1929.

Preliminary insectary tests against eggs of the European corn borer laid on potted corn plants resulted in discarding the following materials from consideration as possible ovicides: Derris powder, pyrethrum, cresylic acid, nicotine sulphate, dipyridyl sulphate, orthotoluidine. White oil gave good results in an emulsion containing 1.5 per cent of oil and will be given further trial.

The following materials will be given further trial as possible larvicides: Derris powder, pyrethrum (in some forms), cresylic acid, acid lead arsenate. Kaolin and lime, used as dusts, gave a marked reduction in larval establishment and will be used as carriers for other materials (p. 23).

WRAY, L., JR. (451)

ON THE MALAYAN FISH POISON CALLED AKER TUBA, DERRIS ELLIPTICA. Pharm. Jour. and Trans. (ser. 3, v. 23), 52: 61–62. 1892.

Derris elliptica is used largely by the Chinese market gardeners as an insecticide, for which purpose the fresh roots are chopped up fine and then pounded and mixed with water, which becomes milky. It is sprayed or brushed over the plants with a bunch of feathers. The toxic principle, tubain, is a reddish brown resinous substance, insoluble in water, paraffin oil, and benzine, but soluble in alcohol, ether, and chloroform. By extraction with alcohol the dried roots yield 9.42 per cent tubain. One part tubain in 1,000,000 parts water will kill fish in from one-fourth to one-half hour, according to species.

——— (452)

ON THE MALAYAN FISH POISON CALLED AKER TUBA, DERRIS ELLIPTICA. Perak Mus. Notes no. 1, p. 19–23. 1893. (On the Experimental Culture of Silkworms in Perak.)

Same as (*451*) except for footnotes. Wray isolated tubain in 1888, and a sample has been exhibited under that name in the Perak Museum since March, 1888.

WRIGHT, G. M. (453)

A PRELIMINARY EXAMINATION OF ROTENONE AND SOME OF ITS DEGRADATION PRODUCTS. Jour. Amer. Chem. Soc. 50: 3355–3360. 1928.

Wright prepared the following derivatives of rotenone: Rotenone-oxime, melting point 252°; rotenone phenylhydrazone, melting point 245°; rotenone hydrochloride, melting point 197°; oxime of rotenone hydrochloride, melting point 239° (with decomposition); rotenone hydrobromide, melting point 190°; isorotenone, melting point 184°; isorotenone phenylhydrazone, melting point 230°; rotenonone, melting point 300°; rotenic acid, melting point 183°; methyl ester of rotenic acid, melting point 39° to 40°; nitrorotenic acid, melting point 187°; tubaic acid, melting point 128° to 129°. In addition, a small quantity of yellow crystals, melting point 255°, containing chlorine were obtained from the mother liquor of the rotenone hydrochloride.

ZAIDAN HOJIN RIKAGAKU KENKYUJO. (454)

A PROCESS FOR PRODUCING A LIQUID INSECTICIDE CONTAINING EFFECTIVE INGREDIENT OF DERRIS SPECIES. Brit. Patent 239483, issued May 6, 1926; applied for April 24, 1925; in Japan, September 8, 1924.

A process of preparing a liquid insecticide containing the effective ingredient of the Derris species comprises the step of preparing a primary reagent in which the effective ingredient is mixed with one or more oils and/or fats, waxes, resins, higher alcohols, higher hydrocarbons, higher fatty acids (excluding Turkey red oil), which are entirely free from water and alkali, and the step of preparing a secondary reagent, in which the primary reagent is mixed as a colloidal solution.

Example 1. A solution of 10 liters of ether containing 10 grams of rotenone is added to a mixture of 400 grams of fish oil and 40 grams of hydrogenated oil. After sufficient agitation, the greater part of the ether is recovered by evaporation and condensation and a semisolid mixture is obtained as a primary reagent. Five hundred grams of soap are mixed with 100 kilograms of water to prepare a colloidal aqueous solution as a secondary reagent. In use the primary reagent is mixed with the secondary reagent. It may be suitably diluted with 100 kilograms of water when used as an insecticide. The secondary reagent may be prepared at any time by users. Example 2. Ten liters of ether are added to 1 kilogram of the derris root. After four days the extract is added to 400 grams of chrysalis oil and 100 grams of lard. After the ether is evaporated a semisolid substance is obtained as a primary reagent. The secondary reagent may be prepared as described in example 1. Example 3. Twenty liters of petroleum ether are added to 1 kilogram of derris root. After four days the extract is added to 200 grams of beeswax and 50 grams of pine resin. The larger portion of the petroleum ether is recovered by evaporation and condensation, and a semicolloidal substance is obtained as the primary reagent. The secondary reagent may be prepared by adding a colloidal solution in which 200 grams of soap are dissolved in 100 kilograms of water.

It is to be understood that substances containing rotenone mean any pure or impure substances obtained from raw root of the Derris species, solutions of the substances in one or more solvents such as methyl alcohol, absolute alcohol, ether, petroleum ether, chloroform, tetrachloride of carbon, and extracts of root of derris with such solvents. The solvents are recovered during the process. By oils is meant all kinds of animal oils, such as sardine oil, herring oil, cod-liver oil, shark oil, ZAIDAN HOJIN RIKAGAKU KENKYUJO—Continued.

and chrysalis oil, and all kinds of vegetable oils, such as coconut oil, bean oil, rapeseed oil, and castor oil. Turkey red oil is excluded. By fats is meant all kinds of animal fats, such as lard, beef tallow, hydrogenized animal oil, and hydrogenized vegetable oil. By waxes is meant wood wax, beeswax and the like, while resins include pine resin, copal, and the like. By higher hydrocarbons, paraffin and the like is intended. Higher alcohol includes glycerin and the like. These substances are selected as desired. Colloidal aqueous solutions include a solution of soap, glue, egg albumin, bean milk, dextrin, starch, bengal, isinglass, animal albumin, and the like. To the aqueous solutions may be added a small quantity of methyl alcohol, ethyl alcohol, chloroform, ether, camphor oil, lemon oil, and other solvents. The additional substances after they are dehydrated may be added to the oils or fats used in preparing the rotenone-containing reagent. Ordinary water also can be employed in place of a colloidal aqueous solution.

——— (455)

A PROCESS FOR PRODUCING A LIQUID INSECTICIDE CONTAINING EFFECTIVE INGREDIENT OF DERRIS SPECIES. Brit. Patent 285797, issued November 29, 1928; applied for February 20, 1928; in Japan, February 18, 1927.

The patentees claim a process for producing a liquid insecticide containing the effective ingredient of Derris species, which comprises forming a primary material in which the effective ingredient is mixed with an anhydrous and alkali-free vehicle for the active ingredient, this vehicle consisting of one or more oils, fats, waxes, resins, higher alcohols, higher hydrocarbons, higher fatty acids, together with a substantially equal quantity of the anhydrous solvent, benzol, carbon tetrachloride or trichloroethane, which primary material is subsequently to be mixed with an aqueous soap solution to form a colloidal solution.

Examples are: (1) To 100 grams of powdered derris root 10 liters of ether is added to extract the effective ingredient. The whole or greater part of the ether is evaporated and recovered. To the residual effective ingredient a mixture of 150 grams of anhydrous and alkali-free fish oil (as a vehicle) and 150 grams of benzol (as the anhydrous solvent) is added, so that a solution of the effective ingredient is thus prepared. This is the improved primary material. The soap solution is easily prepared by, for instance, adding 500 grams of soap to 100 kilograms of water. In use the solution thus obtained is mixed with the improved primary material.

(2) To 1 kilogram of powdered derris root 5 kilograms of benzol is added. The effective ingredient of the derris root is extracted by warming the benzol. The benzol is recovered by evaporation. To the residual effective ingredient, a mixture of 600 grams of anhydrous and alkali-free fish oil (as a vehicle) and 600 grams of carbon tetrachloride (as an anhydrous solvent) is added so that a solution of the effective ingredient is formed. This is the improved primary material. The soap solution employed may be the same as in example 1. Trichloroethane $C_2H_3Cl_3$ as the anhydrous solvent can also be used. Also in the two examples given, the improved primary material can be easily prepared in the form of powder by adding 900 grams of anhydrous gum arabic. Specifications 239483 and 280256 are referred to.

——— (456)

INSECTICIDES. Brit. Patent 300606, applied for July 17, 1928; in Japan November 16, 1927; not yet accepted. Illus. Official Jour. No. 2086, 6904 (1929). Reproduced by permission of the Controller of His Britannic Majesty's Stationery Officer.)

An insecticide containing the active ingredients of derris root without water, alkali, or other detrimental substance is prepared in powder form by mixing the active ingredient with an earth, such as clay, china clay, earthenware clay, or kieselguhr, adding a substance such as calcium carbonate or magnesium carbonate, and pulverizing the mixture. Examples of the invention are: (1) 150 grams of dry kieselguhr are stirred into a concentrated or unconcentrated ether extract of 25 grams of derris root, and the mixture is dried; (2) to the juice produced by repeated crushing of 50 grams of derris root 150 grams of "reddish earth" are added, and the mixture is dried. To each of the above mixtures 45 grams of magnesium carbonate are added, and the mixtures are then pulverized. Sulphur and resin—in the example given, 2 grams each—may be incorporated in the mixtures before they are pulverized.

SUBJECT INDEX

(References are made to the citations by number)

Citation No.

Acreage—
  plants per acre 7, 47, 133
  pounds of roots per acre 17
  statistics 20, 35. 46. 51, 113, 133, 157, 158, 182, 183, 277, 287, 375, 376, 407.
Active principle—
  destroyed by digestive fluids of Bostrichids 130
  determining, chemical method 344
  extracting—
    apparatus 264, 405
    dry roots, method 50. 71. 234. 264, 267, 271, 455
    fresh roots, method 27, 50, 130, 234. 260, 300
    with Ringer's physiological saline solution 67
  osmosis 67
  percentage of, in *Derris elliptica* 149, 150. 405
  (*See also* Derrid, Rotenone, Tubatoxin, etc., and their respective derivatives.)
Adulteration of roots 141, 448
Alimentary canal, absorption from, toxic effects due to 405
Analysis of derris root 365
Animals, action of derris on 81, 384
  amoebae 88
  Bufo melanostictus 67
  cats 61, 177, 178
  cattle 40, 60, 107, 273, 274, 325
  crustaceans (fresh-water) 405
  Cyprinus flavipinnis 150
  Daphnid crustacea 141
  dogs 61. 169, 170, 177, 178, 207, 301
  earthworms 225, 410
  eels 177
  fish 67, 76, 93, 134. 135, 136, 141, 149, 150, 167, 169, 178, 207, 234, 246, 393, 405. 451.
  flagellata 88
  fowl 61, 301, 443
  frogs 141, 177, 178, 207
  Gasterosteus pungitius 178
  gudgeon 141
  guinea pigs 98, 170, 177
  Haplochilus javanicus 149, 150
  Macacus cynomolgus 67
    nemestpinus 67
  mice 177, 178
  molluscs 405
  monkey—
    kra 67
    pig-tailed 67
  nematodes 88
  Ophiocephalus gachua 67
  pigeons 131
  pigs 61
  porcupine 141
  protozoa 88
  rabbits 131, 169, 170, 177, 207
  rats 131, 207, 387
    white 386
  rhinoceros 141
  Rhodeus amarus 246
  rotifera 88
  sheep 61
  slugs 225, 410

Citation No.

Animals, action of derris on—Contd.
  squirrels 301
  tadpoles 67, 141, 405
  tiger 301
  toads 67
  Trichopus trichopterus 234
  water snails 141
Apparatus for extracting derris root 264, 405
Arrow poisons—
  derrid 302
  Derris elliptica 2, 73, 172, 173, 247, 255
    pinnata 172
    uliginosa 172, 173, 255
  tuba root 301
Arsenicals, value, comparison with derris 159, 225, 385
Assaying derris, difficulties 72
Bacteria, action of derris on 88
Biological method of determining insecticidal properties of derris 118, 234
Blood pressure, action of derris on 67, 207
British Malaya, production of derris in 277
Calcium arsenate, value, comparison with derris 225
Cattle—
  dips containing derris 277, 325
  spraying with derris preparation, method 185
Central nervous center, action of derris on 178
Chara foetida, value, comparison with derris 200
Chemistry—
  Derris—
    elliptica 152
    uliginosa 103, 320
Comparative values of different species of Derris 15. 71, 97, 132, 180, 246. 276, 290, 381.
Contact insecticide, derris as 11. 69. 121, 137, 195. 225, 258. 276. 365, 428.
Corrosive sublimate. (*See* Mercuric chloride.)
Cracca (*Tephrosia*)—
  toxicaria, toxicarol from 75. 76
  vogelii, tephrosin from 75. 79, 168, 169
    deguelin from 78
    tephrosal from 168. 169
Cryolite, value, comparison with derris 336
Cubé—
  alcoholic extract. effectiveness. comparison with derris 96
  deguelin from 78
  insecticidal properties 412
  patent on 96
  price 418
  rotenone in 74. 232
  tephrosin in 75
  value, comparison with derris 142
Cultivation of derris root—
  difficulties attending 157
  method 7, 47, 133. 359
  soil, action on 53
  South Africa, attempts to grow derris in 332
Cuttings of derris, source of supply 47

Citation No.
Decomposition of rotenone 93, 133, 213, 214, 386
Deguelia correct name for certain species of derris 41
Deguelic acid 78
Deguelin—
  dehydro 78, 79
  from cube 78, 79
  from *Cracca* (*Tephrosia*) *toxicaria* 78
  from *Cracca* (*Tephrosia*) *vogelii* 78, 79
  from derris 75, 78
  hydroxy 77, 79
  relation between rotenone and tephrosin 77
    to tephrosin 79
Deguelone, dehydro 78
Derric acid 77, 236, 239, 240, 241, 398
Derrid—
  anhydro 221, 295, 320, 405
  from *Derris elliptica* 118, 141, 149, 150, 153, 177, 221, 295, 403, 405.
  from *Lonchocarpus* 154
  from *Mundulea suberosa* 154
  from *Ormocarpum* 154
  in a patented preparation 300
Derrin 246
Derrisic acid 66
  iso 66
Derris extract 384
Derrisine 124, 166, 185, 205, 443
Derrisol 87, 105, 109, 110, 119, 174, 192, 258, 332, 333, 336, 356, 357, 430, 431, 434, 436, 444, 447.
  chemical analysis 109
Derritol 64, 165, 237, 239
  anhydro 64
  cleavage of, and rotenol 368
  derivatives 238
  dihydro 237
  dihydromethyl 238
  iso 165, 237
Derritolic acid, methyl 238, 368
Description (botanical, microscopical, etc.)—
  Dalbergia species 49
  Derris 104, 326
    diadelpha 289
    elliptica 32, 99, 141, 152, 173, 184, 189, 228, 229, 234, 235, 242, 297, 308, 317, 331, 354, 355, 359, 425, 433, 439.
    heptaphylla 184
    heterophylla 184
    koolgibberah 167
    malaccensis 228
    microphylla 184
    pinnata 254, 326
    polyphylla 184
    scandens 24, 29, 184, 289
    species 32, 48, 54, 189, 216, 235, 242, 294, 306, 315, 331, 354, 414, 432, 439.
    uliginosa 32, 33, 54, 68, 86, 103, 148, 189, 216, 235, 242, 249, 250, 254, 289, 294, 306, 314, 353, 354, 358, 362, 363, 377, 414, 437, 439.
  Galedupa—
    frutescens 42
    maculata (*manchado*) 42
    pungam 42
  tuba root 4
Deterioration of derris in storage 56
Diseases of derris 364, 409
  Corticium Salmonicolor 409
Disinfecting derris extract with formalin 234
Duty, export 46, 47
Ether extract, determining, method 133
Evaluating root, chemical method 405
Exports, statistics 114, 133, 182

Citation No.
Fish poisons—
  Barringtonia speciosa 361
  Cocculus indicus 18, 324
  Dalbergia heterophylla 43, 45
  Derris—
    bantamensis 80
    benthami 380
    elliptica 1, 2, 3, 60, 67, 73, 80, 85, 100, 102, 125, 151, 152, 155, 156, 172, 187, 207, 218, 255, 284, 355, 382, 406, 423.
    forsteniana 80, 108, 172
    guianensis 151
    koolgibberah 167
    maingayana 80
    montana 108
    multiflora 108
    negrensis 154
    philippinensis 60
    pinnata 172
    pubipetala 108
    scandens 30, 380
    uliginosa 80, 100, 102, 108, 151, 156, 160, 167, 172, 217, 255, 279, 350, 361, 363, 380.
  Milletia taiwana 219
  Nicou 154
  Paullinia pinnata 31
  Tephrosia—
    macropoda 18
    toxicaria 18
  Timbo 154
Fishing, tuba 125, 171, 191, 212, 286, 302, 361
Formalin, disinfecting derris extract with 234
Freight charges—
  to England 157
  to the United States 376
Fresh root, effectiveness, comparison with alcoholic extract 88
Fruit spray, derris as 277
Fumigant, action of derris as 98, 275, 276
Fungi, action of derris on 88, 120
  Hypomyces 383
Furniture, upholstered, treating with rotenone 25
Galedupa, certain species transferred to derris 42
Genuineness of extract, determining method 405
Germination, action of derris on—
  cabbage 448
  celery 448
  Lima beans 285
  tobacco 288
Habitat—
  Derris—
    elliptica 172
    pinnata 172
    uliginosa 103, 172, 411
Haiari 402
  tubatoxin in 12, 351, 403, 404
Harvesting derris root—
  time of 15, 62, 63
    determining, method 133
Histology—
  Derris—
    elliptica 278
    uliginosa 278
Identifying Derris species, difficulties 129
Imports, statistics 114, 421
Insects, action of derris on—
  Adelges 91
  Aedes 138
    cinereoborealis 139
    excrucians 139
    fitchii 139
    stimulans 139
    vexans 139, 415
  Agromyza phaseoli 285
  Amathusia phidippus 111
  Anasa tristis 91
  Anisota senatoria 233, 276
  Anopheline larvae 382
    Anoplura 427, 433

Citation No.

- Insects, action of derris on—Contd.
  - *Anthrenus vorax* 26
  - ants 140
    - white 190
  - *Anuraphis roseus* 91, 312
  - *Aphididae* 71
  - aphids 8, 11, 19. 57, 69, 71. 91. 92, 93, 98, 118, 196, 205, 233, 258, 275, 276, 288, 317, 443, 447.
    - apple 316
      - green 124. 225
      - woolly 11, 97, 141
    - arrowhead 11
    - bean 141, 404, 405
    - cabbage 11
      - false 89
    - cherry 316, 356, 357
    - chrysanthemum 11
    - citrus 119, 245, 429, 430
      - black 384
      - green 293
    - cone flower 89
    - cotton 96
    - currant 225
    - cutleaf birch 225
    - goldenrod 225
    - hop 119, 447
    - nasturtium 124
    - peach, green 98
    - pear 11, 233
    - plum 11
      - mealy 126
    - potato 225
    - rose 11, 97
    - rosy 298, 312, 423
    - spiraea 89
    - tobacco 50, 52
    - woolly 405
  - *Aphis*—
    - *cardui* 11
    - *gossypii* 91
    - *medicaginis* 71
    - *nerii* 98
    - *persicae-niger* 91
    - *pomi* 91, 225, 276, 429
    - *rumicis* 11, 91, 92, 93, 141, 225, 276, 403, 404, 405.
    - *spiraecola* 89, 293. 429. 430
  - apple datana 276
    - red bug 313
  - aquatic insects 71
  - *Arctornis alba* 370
  - *Argyrotaenia* (*Eulia*) *velutinana* 192
  - arrowhead budweevil 11
  - *Attagenus piceus* 26
  - *Aulacophora femoralis* 11
  - *Autographa brassicae* 233. 276
  - bean beetle, Mexican 89, 91, 206, 434
  - bedbugs 88, 225, 276
  - beetles 97
  - " Bena Kura " 371
  - blackberry leaf miner 87
  - *Blatta germanica* 140
  - *Blattella germania* 91
  - *Bombyx mori* 118
  - boxwood leaf miner 166
  - *Brevicorne brassicae* 91. 93
  - budmoths 225
  - buff-tip 118
  - butterfly 97
  - cabbage—
    - caterpillar 244, 448
    - maggot 55, 56, 57
    - white butterfly 118
    - worm 91, 225, 276
  - Cameria geometer 11
  - carrot—
    - fly 367
  - rust fly 106, 143. 225. 436
  - caterpillars 8. 11. 69. 91, 98. 118, 130, 141, 264. 330
  - Cavariella 57
  - celery. ants on 448
  - Centrocnemis 330
  - *Ceratophyllus fasciatus* 140

Citation No.

- Insects, action of derris on—Contd.
  - Chermes 225
  - *Chilo simplex* 11
  - *Chortophila brassicae* 55, 56
  - Chrysomelidae 303
  - *Cimex lectularius* 225
  - clothes moth 25, 225
  - cockroaches 91, 131,140, 276, 317
    - American 140
  - coconut butterfly 111
  - codling moth 110, 159. 206, 321, 322, 323
  - coffee-berry borer 117
  - Coleopterous larvae 88
  - corn borer, European 206. 450
  - cotton stainer 210
  - croton bug 140
  - *Ctenocephalus*—
    - *canis* 140, 275, 433
    - *felis* 140. 433
  - cucumber beetle 89. 91
  - *Culex pipiens* 138, 141
  - curculio 110
  - currant worm 225
  - cutworms 11, 225
  - *Cydia* (*Laspeyresia*) *nigricana* 251
  - *Datana ministra* 233, 276
  - *Dermanyssus gallinae* 90
  - *Diabrotica duodecimpunctata* 89, 91
  - *Diacricia subcarnea* 11
  - *Dialeurodes chittendeni* 445
  - *Diatraea auricilia* 209
  - Dipterous larvae 88
  - *Doryphora 10-lineata* 91, 233
  - dragon flies 88
  - *Drymonia manleyi* 401
  - *Dysdercus cingulatus* 130
  - *Echidnophaga gallinacea* 433
  - *Echinocremus bipunctatus* 11
  - ectoparasites 140, 317
  - *Empoasca fabae* 95
  - *Epilachna corrupta* 91
  - *Erionota thrax* 111
  - *Eriosoma lanigera* 97, 141. 405
  - *Euphydryas chalcedona* 97, 98
  - *Euproctis*—
    - *conspersa* 11
    - *pseudoconspersa* 370
    - *sericea* 370
  - *Eupteryx flavoscuta* 257
  - fall webworms 57, 225, 276
  - fleas 37, 124, 198, 327
    - on cats 140, 434
    - on dogs 37, 140, 275, 276, 433, 448
    - on rabbits 360
    - on rats 140
    - sticktight 433
  - flies 124, 131, 140, 225, 276
  - flower thrips, Florida 431
  - *Frankliniella tritici bispinosa* 431
  - *Galerucella rubi* 399
  - geometers 11
    - chain dotted 225
  - Giropid lice 98
  - *Gliricola porcelli* 98, 205
  - *Glottula fusca* 211
  - *Goniocotes gigas* 98, 205
  - gooseberry sawfly 118. 141
  - grape leafhopper 93, 105
  - grasshoppers 11, 330
  - grubs on cattle 40. 199, 202, 281, 282. 327, 416
  - Gryllotalpa 371
  - *Gyropus ovalis* 98, 205
  - *Hadena oleracea* 118
  - *Hellula undalis* 429
  - *Heterocordylus malinus* 233, 313
  - *Hippodamia convergens* 97
  - honeybees 142
  - Hoplocampa 11
  - horn fly 185
  - *Hylemia antiqua* 55, 57, 367
  - *Hyphantria carnea* 233
    - *cunea* 57, 225
  - Hypoderma 39, 40, 44, 274, 282. 427
  - *Illiberis pruni* 11

Citation No.
Insects, action of derris on—Contd.
  Illinoia liriodendri 91
  lackey moth 118
  ladybeetle 275
  ladybird beetle 225
  larch case borer 225
   sawfly 225
  Laspeyresia molesta 251
  leaf—
   beetles 11
   hoppers 91, 257, 258, 327
   lice 122, 123
   roller, red-banded 192
  leatherjackets 410
  leatherleaf ferns, leaf hoppers on 327
  Lepidoptera 88, 405
  Leptinotarsa decemlineata 225
  lice 124
   on calves 433
   on cattle 198, 225, 433
   on dogs 433
   on fowl 11, 91, 98, 140, 205, 276, 433, 443
    body 91, 140
    head 57, 140
   on guinea pigs 98, 205
   on horses 225
   on pigs 98
   on rats 140
  Lima bean, pest of 285
  Limacodidae 130
  Linognathus—
   setosus 433
   vituli 433
  Lipeurus heterographus 57, 140
  livestock, pests of 176
  Lucilia flies 311
  Luperodes praeustus 400
  Lygidea mendax 233, 313
  Lymantriids 370
  Macrosiphonella sanborni 275
  Macrosiphum 275
   rudbeckiae 89
   solanifolii 225
  Malacosoma 233
   americana 91, 225
   disstria 225
   neustria 118
  Mallophaga 427, 433
  mealy bugs 19, 91, 276
  Menopon—
   biseriatum 98, 140, 205
   pallidum 91
   stramineum 91
  Metellus rubi 87
  mites on chickens 90, 276
  mole cricket 371
  Monarthropalpus buxi 166
  mosquito larvae 67, 71, 88, 91, 98, 124, 138, 139, 225, 365, 405, 415.
  moths 365
  Musca domestica 225
  mushroom fly 383
  Myzus—
   cerasi 356, 357
   persicae 91, 93, 98, 234, 275, 276, 288
   rosarum 97
  Naraga aenescens 11
  Nematus ribesii 141
  Notodontid 401
  Notolophus posticus 370
  nutmeg trees, pests of 1, 73, 252, 307
  Nymphula depunctalis 372
  oak worms 276
  Olene mendosa 370
  onion—
   flies 367
   maggot 55, 57
   thrips 444
  Orthezia insignis 276
  ox warbles 39, 107, 274
  oyster-shell scale, crawling young of 276
  padi pests 84, 209
  palms, beetles on 111

Citation No.
Insects, action of derris on—Contd.
  Parasa herbifera 130
  pea moth 291
  peach moth, oriental 127, 251
  pear—
   bagworm 11
   psylla 11, 174, 422
   sawfly 11
  Periplaneta americana 140
  Phaedon—
   brassicae 11
   incertum 303
  Phalera—
   bucephala 118
   flavescens 11
  Phymalocera aterrima 118
  Pieris brassicae 118
  pigeon fly 38
  Plant lice. (*See* Aphids.)
  Podops—
   coarctata 371
   lurida 11
  Polyplax spinulosus 140
  Pontia rapae 91, 93
  Popilia japonica 91
  Porthesia—
   scintillans 370
   taiwana 370
  potato—
   beetle 57, 91, 275, 276
    Colorado 225
    three lined 225
   Doryphora of 233
   leafhopper 95
  poultry, pests of 176
  Prodenia litura 234
  Pryeria sinica 385
  Psila rosae 143, 225, 367, 436
  Psylla 69
   pyricola 174
  Pseudococcus citri 91
  Pseudodura dasychiroides 370
  Pterochlorus tropicalis 11
  Pteronus ribesii 118, 225
  Pyralidae 130, 428
  radish pest 56
  red bug—
   bright 313
   dark 313
  red scale 369
  red spider 11, 69, 89, 91, 92, 98, 205, 276
  rhododendron white fly 445
  Rhopalosiphum—
   persicae. (*See Myzus persicae.*)
   pseudobrassicae 89
  Rhynchites heros 11
  roaches. (*See* Cockroaches.)
  rose sawfly 11, 147
  rubber trees, ants on 190
  rush sawfly 11, 175
  sawflies 11, 118, 405
  Schoenobius bipunctifer 209, 371
  Sciara proecox 383
  Scotinophara coarctata 84
  screw-worm flies 310, 311, 349
  silkworms 118, 159, 275
  Solenopotes capillatus 433
  Spilonota ocellana 225
  squash bug 91, 225
  stalk borer, maize 10, 211, 332, 333, 334, 335, 336
  Stegomyia 67
  stem borers 209, 371
  Stephanoderes hampei 117
  Stilpnotia cygna 370
  strawberry—
   beetle 11
   plants, pests of 399, 431
  Syrphid flies 225, 234
  tea plant, pests of 370
  tent caterpillars 275, 276
   forest 225
   Japanese 11
   orchard 225
  termites 88, 89, 190
  Tetranychus telarius 89, 91, 98, 205

Citation No.
Insects, action of derris on—Contd.
  Theobaldia annularis 141
  Thrips 19, 91, 92, 447
    tabaci 91, 444
  ticks—
    on calves 11
    on dogs 88, 448
    on pigs 11
  Tineola bisselliella 26
  Tirathaba 130
  tobacco—
    caterpillars 247
    lice 116, 234, 325, 435
    pests 50, 115, 121, 288
  tomato moth 118
  Tomostethus juncivorus 175
  Trialeyrodes vaporariorum 91
  Trichodectes scalaris 433
  tussock moths 11
  Typhlocyba comes 91, 93, 105
  warbles 44, 107, 124, 199, 273, 274, 425, 426, 427, 433.
  wasps 131
  webworms 275
  white fly 92, 444
Insects attacking derris—
  Amsacta lactinea 128, 129, 130
  Anisodes obrinaria 129, 130
  Arctiidae 128, 129
  Belippa laleana 129, 130
  borers 129, 157
    shot-hole 248
  Bostrichid 82, 130
  Chrysomelid beetle 19, 292
  Creatonotus lactineus 130
  Estigmene lactinea 130
  Eucosma—
    balanoptycha 129, 130
    defensa 129, 130
  Eucosmidae 129
  Geometridae 129
  Hasora—
    alexis 129
    mixta 440
  Hesperiidae 129, 440
  Lamprosema diemenalis 129, 130
  Limacodidae 129
  Mahasena 130
  Maruca—
    amboinalis 129, 130
    testulalis 130
  Neolepta biplagiata 19, 292
  Parata alexis 130
  Pyralidae 129
  red spider 22
  Scolytid 130
  Sinoxylon anale 82
  Striglina scitaria 129, 130
  Tenebrionid 130
  Tetranychus bioculatus 22
  Thyrididae 129
Insects attacking derris, controlling—
  method 19, 292
  investigating 408
Iodoform, value, comparison with derris 425
Kurmange 107
Kymac 10, 332, 334, 335, 336
Lonchocarpus, derrid in 154
Man, action of derris on 2. 3, 67, 81, 138, 140, 225, 226, 229, 247, 301, 330, 365, 447.
Medicinal value—
  Derris—
    elliptica 172
    pinnata 172
    uliginosa 100, 172, 296, 350
Mercuric chloride, value, comparison with derris 56, 57, 143
Mercurous chloride, value, comparison with derris 143
Milletia taiwaniana, rotenone in 23, 219
Mixtures of derris with—
  acetone 26, 89, 91, 93, 127, 214
  animal albumin 454
  arsenates 119

Citation No.
Mixtures of derris with—Contd.
  bean milk 454
    oil 389, 454
  beef tallow 389, 454
  beeswax 389, 454
  Bengal 252, 454
  bentonite 214
  benzol 89
  Bordeaux mixture 105. 119, 174, 225, 271, 312, 447
  bran 410
  calcium carbonate 98, 262, 456
    caseinate 57
    sulphate 262
  casein 120, 271
    lime 126
  castor oil 120, 270, 389, 454
  cement powder 225
  cholesterin 186
  chrysalis oil 389, 454
  clay 55, 456
    china 456
    earthenware 456
  coconut oil 389, 454
  cod-liver oil 389, 454
  copal 389, 454
  cornstarch 37
  creosote 185
  cryolite 336
  dextrine 454
  diatomaceous earth 91
  egg albumin 454
  fish oil 304, 389, 454, 455
  flour 37, 90, 317
    wheat 433
  French chalk 415
  glue 272, 454
  glycerin 454
  gum arabic 304, 455
  gums 214
  gypsum 436
  herring oil 389, 454
  honey 127, 142
  isinglass 454
  kaolin 40, 311, 349
  kerosene 275, 369, 371
  kieselguhr 456
  lard 389, 454
  lead arsenate 244, 271, 379, 447
  lime 225
    milk of 27
  sulphur 119, 120, 245, 312
  magnesium carbonate 456
  molasses 166
  nicotine 262, 433
  nicotine sulphate 312
  oil 119, 176, 323
    animal 389, 454
    hydrogenated 454
    miscible 316
    sulphonated 120, 271
    tar 365
    white 110, 127, 322
    vegetable 389, 454
  olive oil 426
  paraffin 44, 425, 426, 454
  Penetrol 89
  petrolatum 40
  phytosterinoxide 186
  pine oil 185
    resin 389, 454
  pyridine 93, 97, 98, 140, 214
  rape oil 186
  rapeseed oil 389, 454
  resin 456
  saponin 214
  sardine oil 389, 454
  shark oil 389, 454
  sirup 127
  soap 8, 11, 27, 39, 50, 69, 90, 117, 118, 119, 121, 122, 123, 126, 130, 140, 175, 185, 199, 225, 234, 257, 260, 266, 267, 275, 276, 304, 313, 336, 370, 389, 399, 401, 427, 433, 447, 454, 455.
  soda carbonate 27
  sodium oleate 97

Citation No.
Mixtures of derris with—Contd.
  soot 367
  starch 454
    maize 427
  sugar 317
  sulphur 27, 140, 252, 266, 267, 317, 456
  tannic acid 93, 214
  tartaric acid 27
  tobacco 140, 317, 433
  vaseline 57, 199, 433
  wax, sulphonated 120, 271
    wood 389, 454
Moth-proofing agent, rotenone as 25, 26
Mundulea suberosa, derrid in 154
Mushrooms, action of derris on 383
Native names—
  Derris—
    bantamensis 80
    elliptica 63, 80, 172, 184, 234, 247, 375
    forsteniana 80, 108
    heptaphylla 184
    heterophylla 184
    maingayana 80
    malaccensis 63, 234, 375
    microphylla 184
    montana 108
    multiflora 108
    pinnata 172
    polyphylla 184
    pubipetala 108
    scandens 30, 184
    uliginosa 80, 108, 160, 172
Neoton 11
Nicotine—
  Derris as substitute for 137, 325, 384
  value, comparison with derris 52, 89, 91, 92, 112, 118, 140, 166, 312.
Nicotine sulphate, value, comparison with derris 126, 166, 174, 234, 257, 332, 430, 431, 434, 443.
Nicoulin from *Robinia nicou* 131, 154
Odor of derris 140, 425, 426
Ormocarpum, derrid in 154
Ovicide, action of derris as 11, 105
Pachyrhizide—
  comparison with other active principles 218
  from *Pachyrizua angulatus* 366
Palate, action of derris on 2
Paris green—
  Derris as substitute for 226
  value, comparison with derris 410
Patents on derris 27, 28, 120, 186, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 300, 304, 305, 389, 454, 455, 456.
  review 345
Paullinia pinnata 31, 318
Phenol, value, comparison with derris 134
Phytophyline 117
Plants, action of derris on 225, 447
  apple trees 313, 379
  cabbage 55, 448
  celery 448
  citrus tree 429
  maize 10, 211, 332, 333, 334, 335, 336
  rubber trees 190
  tobacco 247, 288, 325
Polvo 57
Potassium cyanide, value, comparison with derris 134
Powder, derris, preparing, method 27
Price of derris 4, 7, 17, 46, 47, 51, 55, 56, 62, 112, 133, 157, 277, 287, 325, 332, 333, 335, 376, 419, 426, 448.
  of cubé 418

Citation No.
Proprietary preparations containing derris 10, 11, 40, 57, 87, 105, 107, 109, 110, 117, 119, 124, 126, 166, 174, 185, 192, 205, 258, 273, 274, 275, 298, 310, 312, 313, 322, 332, 333, 334, 335, 336, 356, 357, 365, 384, 427, 429, 430, 431, 434, 436, 443, 444, 447.
  manufacturers 11, 107, 109, 365
Pulvex 124, 335, 336
Pyrethrum, value, comparison with derris 38, 89, 105, 139, 140, 145, 310
Qualitative test for determining tubatoxin 405
Quantitatively determining insecticidal properties of derris, biological method 118
Respiratory center, action of derris on 67, 98, 177, 178
Restrictions on exportation of derris seed 53
Rissic acid 398
Robinia nicou, nicouline from 131, 154
Rotenic acid 66, 163, 164, 220, 221, 222, 223, 387, 388, 391, 393, 394, 396, 397, 453
  acetyl 223
  attempts to synthesize 397
  constitution 396
  dihydro 66, 394
    brucine salt 396
  isomeric 391
  methyl ester 394, 453
    ether 220
  nitro 388, 453
    methylated 388
Rotenol 64, 164, 165, 220, 238, 239, 394, 397
  cleavage of, and derritol 368
  dihydro 64, 238
  iso 237
Rotenolic acid 238
  dihydro 238, 368
Rotenolone 239
  acetyl 241
  acetyldihydro 241
Rotenolonic acid, dihydro 241
Rotenone—
  alkali fusion 165, 220
  aqueous suspensions as insecticides 214
  comparison with other active principles 218
  constitution 236
  decomposition of 93, 213, 214, 323
  degradation products 453
  dehydro 64, 66, 213, 239, 240, 241
  derivatives 64, 66, 220
    alkali fusion of 165
  determining, chemical method 344
  dihydro 64, 221, 237, 393
  β-dihydro 162
  dihydrodesoxy 64
  hydrobromide 453
  hydrochloride 388, 453
  hydrochloride, oxime of 453
  in cube 74, 232, 347
  in *Derris chinensis* 299
  in *Milletia taiwaniana* 23, 219
  in timbo 232
  iso 66, 162, 237, 388, 390, 393, 395, 453
  iso, phenylhydrazone 453
  isodehydro 66
  isodihydrodesoxy 66
  molecular formula 390
  optical rotation 215
  oxidation products 64
  oxime 388, 453
  perhydro 64
  phenylhydrazone 453
  reduction products 64, 237
  relation between deguelin and tephrosin 77

Citation No.
Rotenone—Contd.
    between isorotenone 162, 395
  solubility 215
  toxicity in solution and suspension, change in 93
Rotenonic acid 162, 165
  acetyl- -dihydrohydroxy 241
  dehydro 241
  dehydrodihydro 241
  dehydrodihydroxy 239, 240
  β-dihydrohydroxy 241
  dihydroxy 165
  hydroxy 241
  isodihydroxy 165
Rotenonone 64, 213, 239, 387, 453
Rotenononic acid—
  dehydrodihydro 241
  dehydrodihydroxy 241
Rubber plantations, cultivation of derris near-by a menace 53
Sandwich method in determining toxicity of rotenone 281
Serjania lethalis 255
Sheep dips containing derris, preparing, method 27, 28, 120, 260, 261, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272.
Shipping derris root, lack of satisfactory method 287
Skin, action of derris on 40, 221
  diseases—
    creeping eruption 230
    mange 448
    sarna or Kraeze of cattle 11
    scurf 325
    sheep scab 226
Sodium fluoride, value, comparison with derris 427, 433, 443
Solvents for insecticidal constituents of derris—
  acetic acid 177, 207, 318
  acetone 177, 186, 207, 215, 246
  alcohol 98, 150, 177, 186, 207, 244, 246, 275, 290, 295, 318, 320, 386, 387, 405, 451, 454.
    amyl 150, 207
    denatured 276
    ethyl 98, 389, 454
    methyl 98, 207, 389, 454
  alcohols, lower aliphatic 215
  benzene 120, 177, 207, 215, 219, 246, 271, 275, 304, 317, 318, 405, 455.
  benzine 141, 264, 267
  benzol. (*See* Benzene.)
  camphor oil 454
  carbon tetrachloride 304, 389, 405, 454, 455
    disulphide 177, 318
  chlorobenzene 215
  chloroform 76, 141, 150, 177, 207, 215, 246, 295, 318, 320, 389, 451, 454.
  cresylic acid 272
  ether 40, 76, 97, 98, 132, 133, 150, 177, 186, 207, 246, 290, 295, 304, 318, 320, 386, 387, 389, 405, 451, 454, 455, 456.
    acetic 295
    petroleum 98, 141, 177, 207, 246, 320, 389, 454
  ethyl acetate 177, 230
  ethylene dichloride 215
    chlorohydrin 215
  fish oil, menhaden 215
  glycerol 207
  hydrocarbon white oil 305
  lemon oil 454
  olive oil 207
  paraffin 141
  petroleum 317
  pine oil, steam distilled 215
  pyridine 98
  toluene 141, 207, 215, 318
  trichloroethane 304, 455
  trichloroethylene 215
  wood spirit 365

Citation No.
South Africa, attempts to grow derris in 332
Sprays containing derris, preparing, method 50, 130, 234, 448
Stainless properties of derris 38, 147
Stomach—
  detecting presence of derris in, method 141
  insecticide, derris as 69, 98, 195, 276, 365, 427
Storing derris root 50
Strength of derris extract, determining, method 112
Suicide with derris 58, 67
Sulphur, value, comparison with derris 146
Supply of derris, sources 47, 94, 276, 419
  of cubé, sources 418
Synonomy—
  Derris—
    elliptica 151, 152
    guianensis 151
    Lour 255
    uliginosa 151, 255
Taste of derris 1, 2, 73, 359, 410
Tephrosal 168, 169
Tephrosin—
  composition 79
  from *Cracca* (*Tephrosia*) *vogelii* 75, 168, 169, 170
  in cube 75, 79
  in derris 75, 79
  patent on 272
  relation to deguelin 79
    between rotenone and deguelin 77
Timbo, rotenone in 232
  scientific name 255, 318
Timboin—
  comparison with other active principles 218
  from timbo 154, 318
Timbol from timbo 318
Tobacco dressing, value, comparison with derris 107
Tongue, action of derris on 2, 359
Toxicarol—
  from *Cracca* (*Tephrosia*) *toxicaria* 75, 76
  in derris 75, 76
Tracheal poison, derris as 98
Tubaic acid 64, 66, 164, 165, 220, 221, 222, 223, 224, 236, 391, 392, 393, 453.
  chlorodihydro 224
  desoxydihydro 224
  dihydro 64, 165, 220, 221, 222, 224, 241, 391, 393, 394, 396.
  iso 163, 164, 165
  methyl ether 224
Tubain 405, 451, 452
Tubanol 164, 391
  chlorodihydro 224
  dihydro 224, 391
Tubatoxin—
  comparison with other active principles 218
  destroyed by digestive fluids of Bostrichids 130
  diacetyl 218
  from *Derris elliptica* 12, 118, 207, 208, 218, 219, 351, 386, 387, 403, 404, 405.
  in haiari 12, 351, 403, 404
  qualitative test for determining 405
Tubotoxin. (*See* Tubatoxin.)
Vermifuge containing derris, preparing, method 27, 28, 259, 260, 261, 263, 264, 265
Voluntary and involuntary muscles, action of derris on 67
Weight of roots per plant 7
Woolen goods, treating with rotenone 26
Zeisel method in determining genuineness of derris extract 405

CHRONOLOGICAL INDEX

	Citation No.
1747	249, 355
1775	24
1793	254
1801	250
1807	315
1811	283
1814	353
1819	326
1825	45, 68
1826	377
1830	324
1832	99, 354, 424
1833	437
1834	439
1837	42, 49
1839	301
1843	438
1844	179
1845–46	297
1848	307
1849	252
1853	216
1854	148
1855	294
1857	406
1858	43, 253
1859	181
1860	32
1861	86, 350
1862	361, 362
1862–1867	34
1863	31
1864	33, 411
1866	212
1867–1873	363
1871	306
1876	108
1877	235
1878	187
1879	188, 189
1886	1
1887	73
1888	296
1890	2, 48, 103, 149, 150, 423, 432
1891	318
1892	451
1893	151, 452
1894	104, 414
1895	131
1896	152
1897	172, 228, 329
1898	3, 100, 153
1899	154, 279, 366
1900	155
1901	173, 435
1902	125, 299, 314, 319
1903	320
1904	302
1905	88, 284, 295, 308
1906	54
1907	168, 169, 170, 255, 286
1908	30
1909	80
1910	190, 193
1911	177, 178, 246, 264, 265
1912	160, 191, 266, 289, 330, 448
1913	156, 267, 382
1915	37
1916	67, 167, 207, 242
1917	194, 208
1918	195
1919	29, 196, 276, 337
1920	58, 111, 161, 285, 358, 371
1921	4, 55, 59, 60, 197, 313, 367, 383
1922	39, 56, 140, 198, 210, 331, 372, 413, 433, 443.
1922–23	205
1923	5, 6, 23, 96, 118, 141, 199, 209, 218, 219, 247, 364, 378, 386, 405, 427, 441.
1924	7, 8, 27, 28, 81, 84, 90, 98, 117, 121, 122, 200, 221, 233, 259, 273, 274, 275, 373, 384, 409, 420.
1925	50, 57, 123, 128, 129, 130, 166, 171, 175, 185, 201, 217, 222, 223, 256, 260, 261, 262, 263, 268, 269, 270, 278, 316, 374, 387, 402, 425, 429, 442.
1925–26	351
1926	9, 69, 70, 71, 82, 107, 119, 120, 157, 225, 226, 230, 245, 257, 271, 277, 290, 291, 300, 303, 309, 325, 332, 357, 404, 415, 430, 447, 454.
1927	10, 11, 44, 102, 105, 180, 184, 192, 202, 244, 272, 288, 310, 333, 349, 365, 370, 376, 401, 403, 426, 428, 431.
1927–28	352, 434
1928	12, 13, 22, 35, 36, 62, 64, 65, 72, 83, 85, 87, 95, 112, 126, 137, 138, 142, 147, 158, 186, 203, 224, 229, 243, 248, 258, 280, 298, 311, 321, 327, 328, 334, 335, 338, 360, 375, 380, 381, 385, 388, 399, 410, 422, 440, 444, 446, 453, 455.
1929	14, 15, 16, 38, 41, 63, 74, 94, 106, 109, 110, 113, 114, 115, 132, 133, 139, 143, 144, 176, 211, 231, 234, 237, 251, 281, 293, 322, 339, 340, 341, 356, 369, 389, 390, 391, 392, 397, 400, 407, 412, 436, 445, 450, 456.
1930	17, 18, 19, 20, 21, 26, 40, 46, 47, 51, 52, 53, 61, 66, 75, 76, 91, 92, 97, 124, 127, 134, 135, 145, 146, 159, 163, 164, 165, 174, 204, 206, 215, 220, 227, 232, 236, 238, 239, 240, 241, 282, 292, 304, 305, 312, 317, 336, 342, 343, 344, 345, 346, 359, 368, 379, 393, 394, 395, 396, 408, 416, 418, 419, 449.
1931	25, 77, 78, 79, 89, 93, 116, 136, 162, 182, 183, 213, 214, 287, 323, 347, 348, 398, 417, 421.

U. S. GOVERNMENT PRINTING OFFICE: 1932